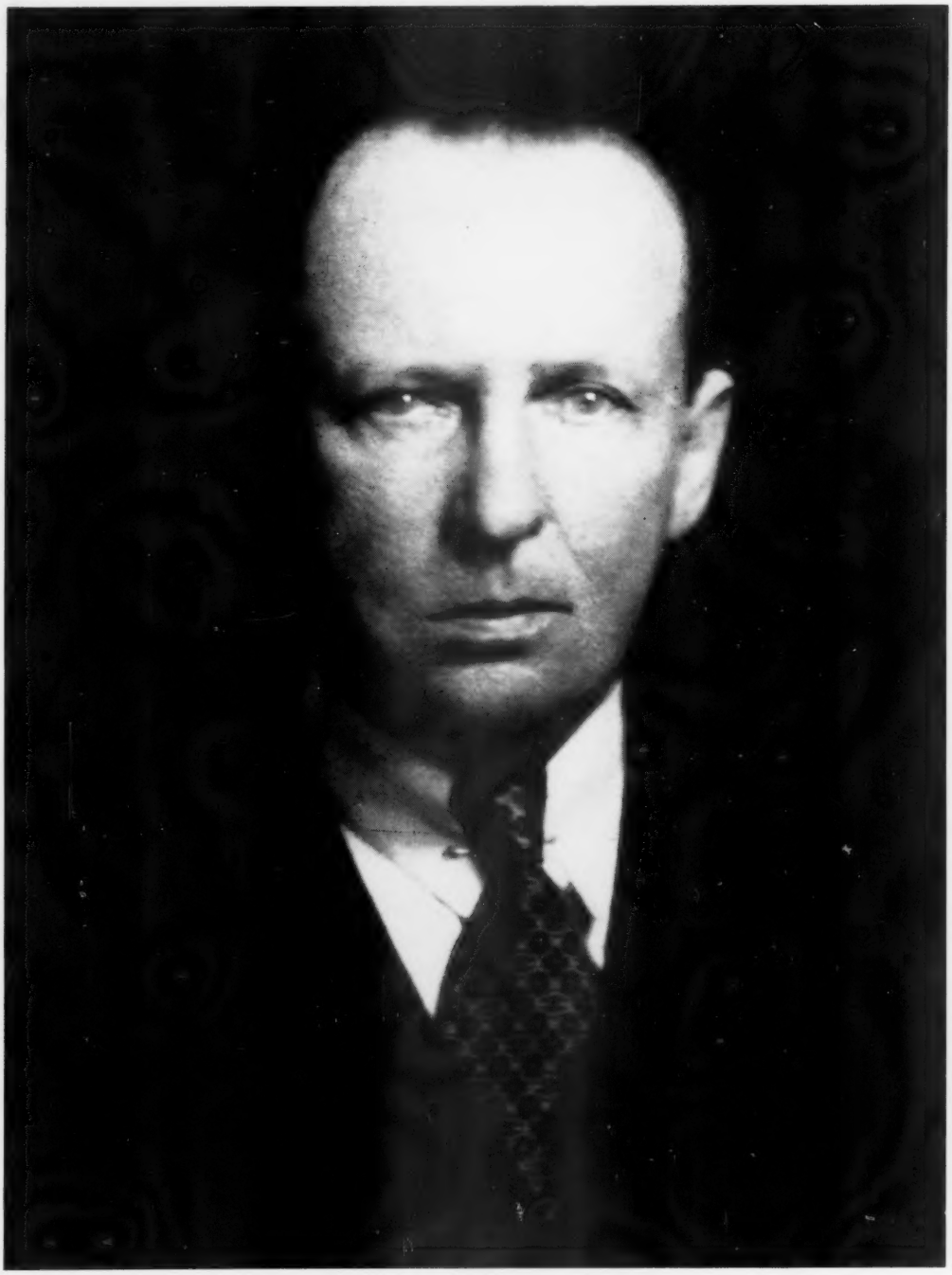
THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

Volume 20 MARCH, 1941 Number 3



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LORD BALTIMORE HOTEL

MARCH 30–APRIL 5, 1941

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THE BULLETIN OF THE AMERICAN CERAMIC SOCIETY

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DIRECTORY OF MEETING ROOMS

Ceramic Camera Club and Ladies Headquarters	(All Week)	Mezzanine Floor
General Session		Calvert Room
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Refractories	G, H, I, J	Private Dining Rooms
Structural Clay Products	A, B, C	
White Wares	D, E, F	

Publication Office: 20th & Northampton Sts., Easton, Pa.
Editorial, Executive, and Advertising Offices: 2525 N. High St., Columbus, Ohio.
Committee on Publications: J. D. SULLIVAN, *Chairman;* E. E. MARBAKER, J. B. AUSTIN, A. N. FINN, ROSS C. PURDY.

Entered as second-class matter at the post office at Easton, Pa., under the act of March 3, 1879. Published monthly.
Subscription $1.50 a year. Single numbers twenty-five cents.
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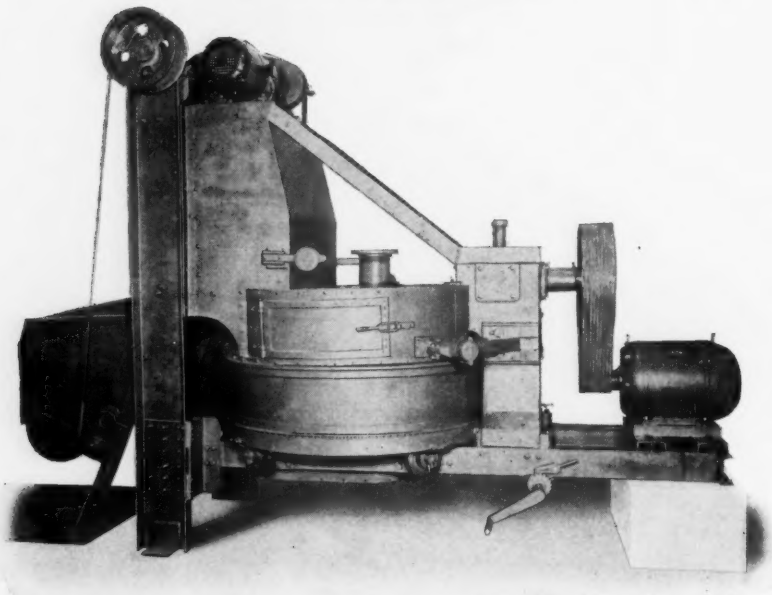

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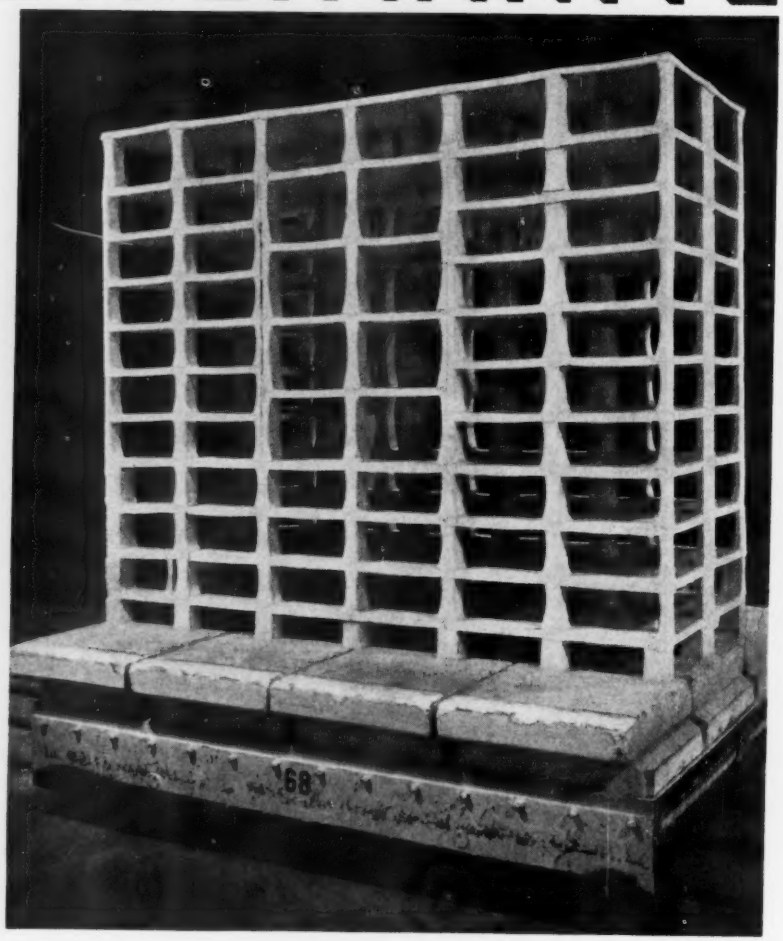

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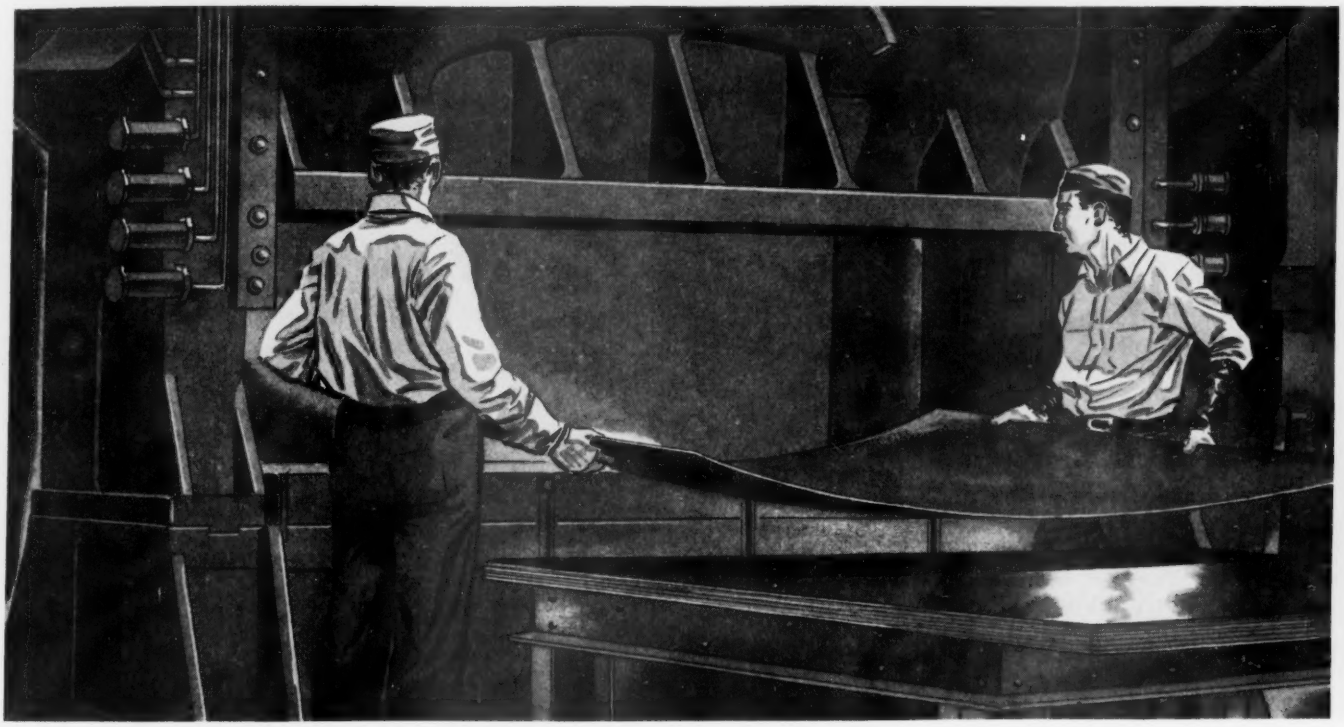

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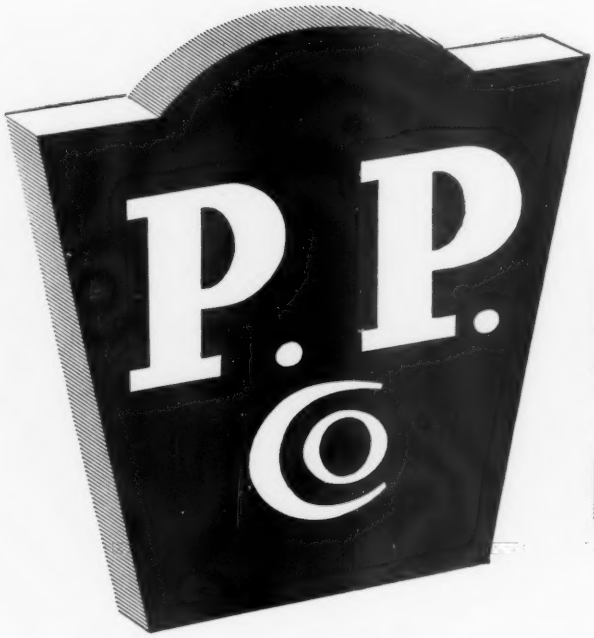

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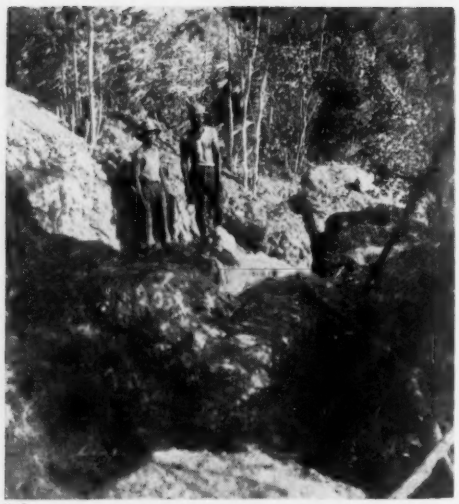

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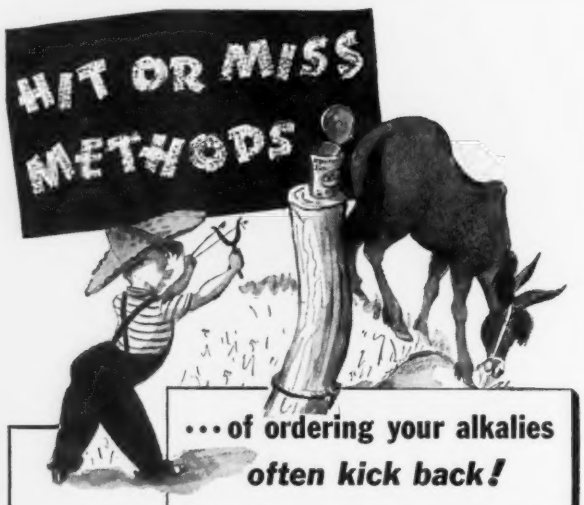

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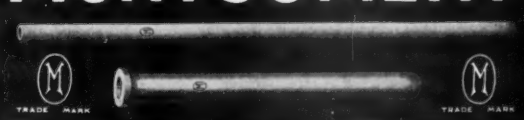

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Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Barium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Basic Oxides
Porcelain Enamel and Mfg. Co.

Batch Systems
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Batts
Carborundum Co. (*"Carbofrax Aloxite"*)
Denver Fire Clay Co.
Norton Co. (*Alundum-Crystolon*)

Beryl
Foote Mineral Co

Bichromate of Soda
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Bitstone
Potters Supply Co.

Blocks (Refractory)
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Louthan Mfg. Co.
Norton Co.
The Vitro Mfg. Co.

Body Stains
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel, O., Co., Inc.

Bone Ash
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Borax
American Potash & Chemical Corp.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Borax Glass
American Potash & Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Anhydrous)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. (*"Carbofrax Aloxite"*)
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.
The Vitro Mfg. Co.

Cadmium Sulphide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Solvay Sales Corp.

Caustic Soda
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Cements
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.
Pennsylvania Salt Mfg. Co.
Sauereisen Cements Co.

Ceramic Chemicals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Cerium Oxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.

Chromium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Ball)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
United Clay Mines Corp.
The Vitro Mfg. Co.

Clay (Bentonite)
Great Lakes Foundry Sand Co.

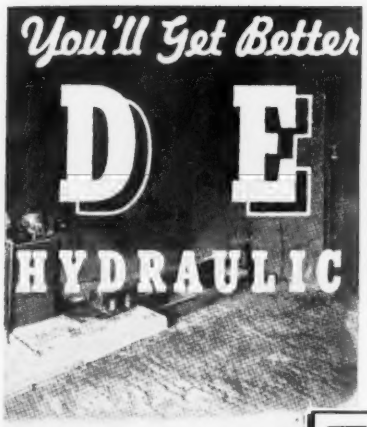
Clay (Block)
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Clay (China)
Ceramic Color & Chemical Mfg. Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.
The Vitro Mfg. Co.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

Clay (Electrical, Porcelain)
Ceramic Color & Chemical Mfg. Co
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Enamel)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Metal & Thermit Corp.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.
Spinks, H. C., Clay Co.



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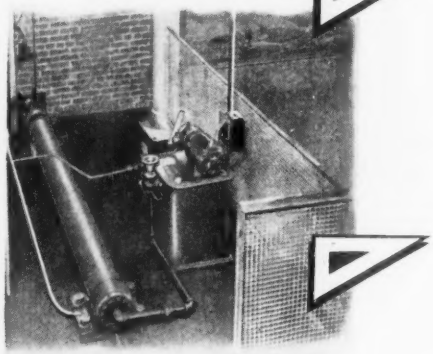

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There are reasons for this wide preference. Ceramic manufacturers and kiln builders have found, through years of experience, that Dension equipment just can't be beaten for production efficiency and long range economy.

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MEET ANY OPERATING CONDITION

Denison Hydraulic Car Propellers are made in several types, to meet every kind of controlled-movement requirement in the processing of materials through kilns, dryers or furnaces. The actual application of each propeller is especially designed to fill the exact conditions of the individual installations.

Denison also designs hydraulic propeller equipment for return and loading tracks, and for all types of special heat-treating and other continuous-motion operations, where hydraulic power has proved to be more accurate, dependable and economical.

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Clay (Fire)
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Great Lakes Foundry Sand Co.
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Paper Makers Importing Co.
Potters Supply Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

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Drakenfeld, B. F., & Co.
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Harshaw Chemical Co.
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Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Micronized)
Porcelain Enamel and Mfg. Co.

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Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Potters)
Denver Fire Clay Co.
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Process Equipment)
Lancaster Iron Works, Inc.
National Engineering Co.

Clay (Sagger)
Georgia Kaolin Co.
Great Lakes Foundry Sand Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay-Slip (Albany)
Hammill & Gillespie, Inc.
United Clay Mines Corp.

Clay (Wad)
Kentucky Clay Mining Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
Thomas Albama Kaolin Co.
United Clay Mines Corp.

Clay (Wall Tile)
Hammill & Gillespie, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Cleaners
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.

Cleaners, Chemical
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.

Clocks (Gauge Board)
The Hommel, O., Co., Inc.

Cobalt Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cobalt Sulphate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Colors
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cone Plaques
Industrial Ceramic Products, Inc.

Cones
Accurate Pyrometric Cone Co.
The Edward Orton, Jr., Ceramic Foundation

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Copper Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Eureka Flint & Spar Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Pennsylvania Pulverizing Co.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Denver Fire Clay Co.
Norton Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Decorating Supplies
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.
National Engineering Co.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Porcelain Enamel and Mfg. Co.

Enameling Equipment (Complete)
Ceramic Color & Chemical Mfg. Co.
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
Ceramic Color & Chemical Mfg. Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
Ceramic Color & Chemical Mfg. Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Enamels
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.

Enamels (Porcelain)
Ceramic Color & Chemical Mfg. Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
Ceramic Color & Chemical Mfg. Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.

Feldspar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Eureka Flint & Spar Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Pennsylvania Pulverizing Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.
Taylor, Charles, Sons Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Denver Fire Clay Co.
Great Lakes Foundry Sand Co.
Green, A. P., Fire Brick Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Flint
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Pennsylvania Pulverizing Co.
Porcelain Enamel and Mfg. Co.

Flint Pebbles
Ceramic Color & Chemical Mfg. Co.
Eureka Flint & Spar Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

French Flint
Eureka Flint & Spar Co.
Maxson, Elwyn L.
Paper Makers Importing Co.

Frit
Ceramic Color & Chemical Mfg. Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Fuel Oil Systems and Control, Stokers
Frazier-Simplex, Inc.

Furnaces
Carborundum Co. (*Carboradiant*)
Denver Fire Clay Co.
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Swindell-Dressler Corp.

Furnaces, Enameling
Swindell-Dressler Corp.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

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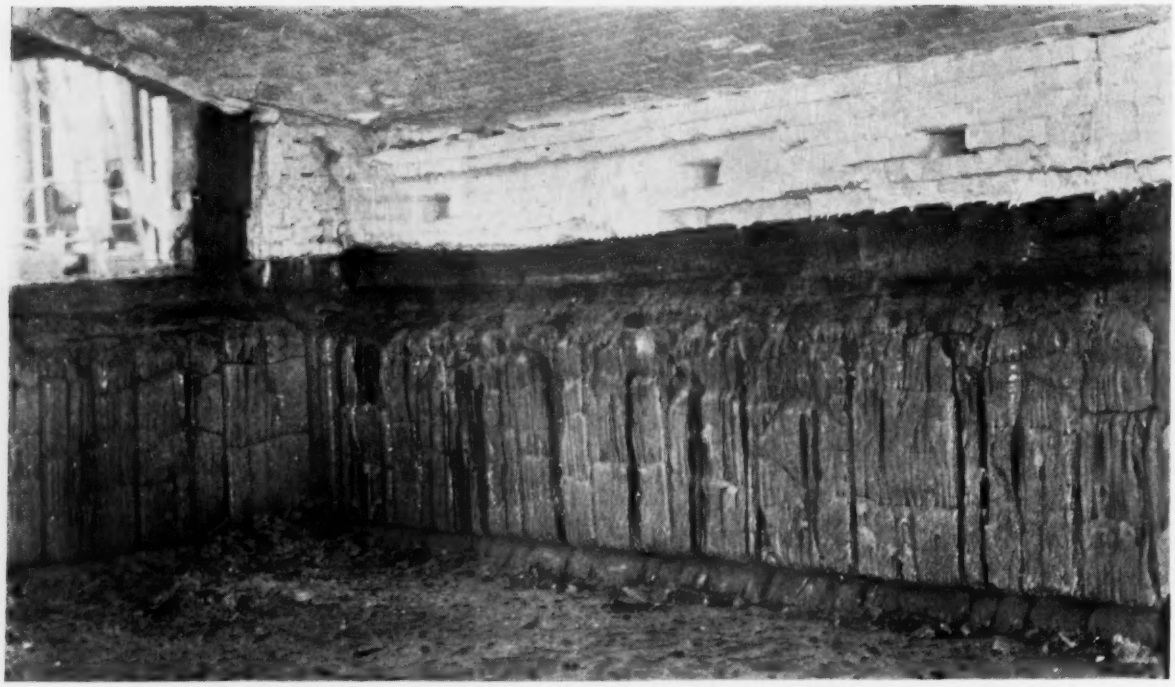

Another *Excellent* Record With Corhart* Electrocast

DURING the past decade, the glass industry has made amazing strides in efficiency and productiveness. But most glass men are considerably surprised when they compare their present records with those of, say, ten years ago.

To make a comparison of different tanks or campaigns, the first requirement is, of course, an adequate yard-stick. This company has often suggested that the best yard-stick or common denominator is the *tons produced per square feet of melting area.*

Ten years ago, 20 tons per sq. ft. of melting area was considered a good production. Thirty tons was considered excellent. Now, however, these figures have gradually risen until 80 or 100 tons is not unusual, and even higher productions are being recorded.

Here, for instance, are the statistics from the Corhart* Standard Electrocast tank pictured above:

Fire placed in tank—May 23, 1938	
Closed for repairs—November 28, 1940	
Melting-end size—18′ x 29′—522 sq. ft.	
Total days of life	920
Operating days	839
Days idle for repairs, floods, etc.	38
Days idle for holidays	43
Total tons glass drawn	63,940
Tons glass produced per operating day	76.21
Sq. ft. melting area per ton per operating day	6.84
Tons produced per sq. ft. of melting area	122.49

Records such as this are naturally a result of three factors: better design, better refractories, better operation. This company is glad that its products are having some share in the industry's steady progress. . . .

Corhart Refractories Company, Incorporated, 16th and Lee Streets, Louisville, Kentucky.

*Not a product, but a trade-mark.

QUALITY ECONOMY ENDURANCE

CORHART
ELECTROCAST
REFRACTORIES

THE BULLETIN

OF THE AMERICAN CERAMIC SOCIETY

A Monthly Publication Devoted to Proceedings of The Society and Promotion of Cooperative Research of Technical, Scientific, and Art Questions

Volume 20 MARCH, 1941 Number 3

FORTY-THIRD ANNUAL MEETING OF THE AMERICAN CERAMIC SOCIETY, INC.

BALTIMORE, MARYLAND, MARCH 30 to APRIL 5, 1941

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MEETING SCHEDULE

	Saturday March 29	Sunday March 30	Monday March 31	Tuesday April 1	Wednesday April 2	Thursday April 3
Breakfast			Editorial	Editorial	Board of Trustees	
Forenoon		10:00 A.M. Board of Trustees Meeting	General Session Orton Lecture	Division Meetings	Division Meetings	Division Meetings / Plant Trips
Luncheon		Board of Trustees Luncheon	General	Glass / Structural Clay Products / White Wares	Refractories / Enamel	
Afternoon	Board of Trustees	Ceramic Educational Council / Ladies' Tea	General Sessions (1) Silicate Analysis (2) Color Symposium / Ladies' Bus Trip / Institute of Ceramic Engineers 4:30 P.M.	Division Meetings / Ladies' Bus Trip	Division Meetings / Ladies' Bus Trip	Plant Trips
Dinner / Night	Local Committees with Board of Trustees	Fellows dinner meeting / 9:00 P.M. Dance	Keramos dinner meeting / 8:30 P.M. Institute of Ceramic Engineers	Alumni dinner meetings / 9:00 P.M. Night on Chesapeake	8:30 P.M. Student Reception	Museums and Universities

Good Fellowship Times at Forty-Third Annual Meeting March 30 to April 5

The Local Committee has plans and commitments completed for happy fellowship opportunities to compliment the serious technical sessions.

Ladies' Entertainment

Ruth Roche (Mrs. L. C.) has arranged occasions especially for the ladies, taking advantage of the several unique attractions which make Baltimore distinctly different from other cities.

General

The schedule of social events is as follows:

(1) Sunday night, 9:00 P.M.: Open House, midnight dance and entertainment (no admission charge).

(*a*) B. & O. Glee Club: Half-hour of song by one of the best men's glee clubs in the East.

(*b*) "Mephistopheles, the Great": Magic act that mystifies even the performer.

(*c*) "Madame La Zonga": Q songs à la grand opera.

(2) Monday, 12:00 M.: General luncheon ($1.00), *no speaking;* song leader and musical strollers, each with pep.

(3) Tuesday night, 9:00 P.M.–1:00 A.M.: Night on the Chesapeake—entertainment, dancing, and refreshments à la Maryland ($1.50 a person).

The clipper ship "Ceramics" will sail down the bay on a moonlight cruise with Admiral Jack Carruthers at her helm. Dancing on deck from 9:00 P.M. to 1:00 A.M. On reaching the oyster beds, the ship will cast anchor and the passengers will refresh themselves with bivalves and other delicacies taken from the waters of the bay. A nautical floor show will follow.

For the "Night on the Chesapeake" event, the Ballroom will be decorated in a nautical fashion. The following menu will be used for the Oyster Roast:

CELERY OLIVES PICKLES
OYSTERS ON THE HALF SHELL
FRIED OYSTERS OYSTER FRITTERS
FRESH SHRIMP
HAM AND CHEESE SANDWICHES
PEPPER HASH COLE SLAW
BEER COFFEE

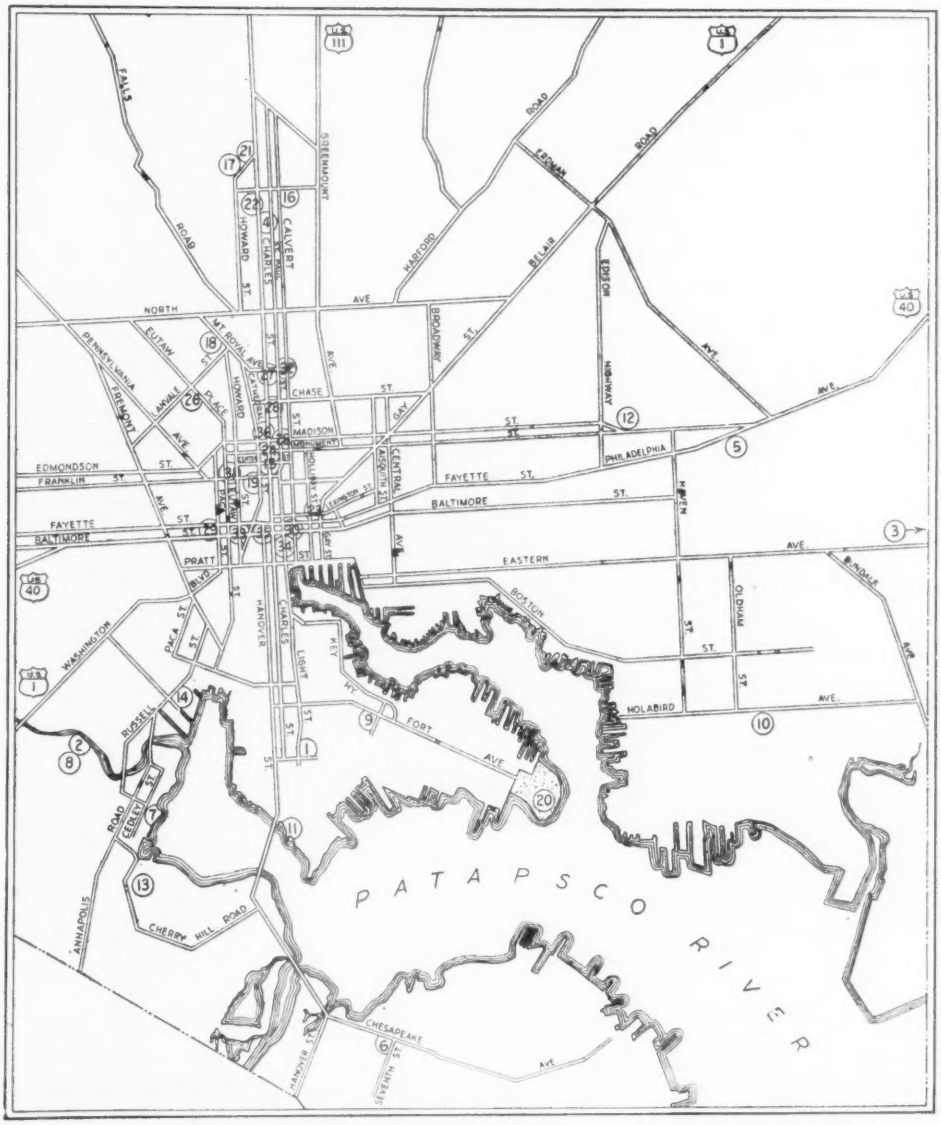
The floor show will include a Master of Ceremonies, a chorus, and several typical vaudeville acts and will last approximately one hour.

(4) Wednesday night, 8:30 P.M.: Student Reception—college songs with a professional leader supported by a "rah-rah" orchestra. Come and see the students herded by their profs and smiled upon by girl friends. Get acquainted with the ceramic stalwarts of tomorrow.

Plant Trips

Thursday and Friday: Trips to plants, universities, museums, Annapolis, and Washington. The federal bureaus will have special occasions.

MAP OF BALTIMORE



(1) National Enameling and Stamping Co., 1901 Light St.
(2) Baltimore Enamel & Novelty Co., Mt. Winans.
(3) Porcelain Enamel & Mfg. Co., Eastern and Pemco Aves.
(4) Severn Ceramic Studio, 2618 St. Paul St.
(5) Harry C. Weiskittel Co., Inc., 4901 Philadelphia Rd.
(6) General Refractories Co., 701 Chesapeake Ave.
(7) Carr-Lowrey Glass Co., Westport.
(8) Maryland Glass Corp., Mt. Winans.
(9) Buck Glass Co., Fort Ave. and Lawrence St.
(10) American Radiator & Standard Sanitary Corp., 5315 Holabird Ave.
(11) Locke Insulator Corp., Charles and Hanover Sts.
(12) Baltimore Brick Co., 3601 E. Monument St.
(13) Westport Paving Brick Co., Westport.
(14) Swindell Bros., Inc., Bayard and Russell Sts.
(15) Walters Art Gallery, Charles and Centre Sts.
(16) Chen Chao Ming (Chinese Antiques), 339 E. 29th St.
(17) Baltimore Museum of Art, Charles St. and Art Museum Dr.
(18) Maryland Institute, Mt. Royal Ave. and Lanvale St.
(19) Enoch Pratt Free Library, Mulberry and Cathedral Sts.
(20) Fort McHenry and Marine Museum, foot of Fort Ave.
(21) Johns Hopkins University, North Charles and 33rd Sts.
(22) Maryland Academy of Sciences, North Charles and 27th Sts.
(23) Municipal Museum (Peale's), Lexington St. and Holliday.
(24) Washington Monument, Mt. Vernon Place.
(25) Abbey Hotel, St. Paul and Madison Sts.
(26) Altamont Hotel, Eutaw Place and Lanvale St.
(27) Arundel Hotel, Charles St. and Mt. Royal Ave.
(28) Belvedere Hotel, Charles St. at Chase.
(29) Biltmore Hotel, Paca and Fayette Sts.
(30) Emerson Hotel, Baltimore and Calvert Sts.
(31) Congress Hotel, Franklin and Howard Sts.
(32) Mt. Royal Hotel, Mt. Royal Ave. and Calvert St.
(33) New Howard Hotel, Howard and Baltimore Sts.
(34) Southern Hotel, Light and Redwood Sts.
(35) Lord Baltimore Hotel, Baltimore and Hanover Sts.
(36) Stafford Hotel, Charles and Madison Sts.

Baltimore Hotels

Invite you to make accommodations while attending the

FORTY-THIRD ANNUAL MEETING,
THE AMERICAN CERAMIC SOCIETY

BALTIMORE, MARYLAND, MARCH 30 to APRIL 5, 1941

A few of Baltimore's many Hotels

LORD BALTIMORE—Headquarters

EMERSON—SOUTHERN—BELVEDERE

MT. ROYAL—NEW HOWARD—ARUNDEL

STAFFORD—CONGRESS—MARYLAND

THE STAR SPANGLED BANNER

Fort McHenry, with its antiquated guns frowning over Baltimore harbor, is one of the nation's foremost historic shrines—the birthplace of the Star Spangled Banner. Our National Anthem was written in Baltimore on the 14th of September, 1814, by Francis Scott Key, a native of Frederick, Maryland.

After the burning of Washington, the British fleet, comprising sixteen bomb and rocket vessels convoying 5,000 land troops, sailed up the Chesapeake Bay to capture the city of Baltimore. The British soldiers debarked at North Point and advanced on the city, while the warships prepared to attack Fort McHenry. On the evening of September 12, Key went aboard the British flagship to arrange for the release of Dr. William Beanes, a native of Maryland, who had been arrested by the British. Because of the impending battle, Key was returned to his flag-of-truce ship under a marine guard and forced to remain immediately in rear of the fleet.

Shot and shell rained upon McHenry's ramparts throughout the next day and night. Toward morning of the fourteenth, Key's anxiety was multiplied a hundred-fold when, by reason of its ineffective range, the Fort ceased fire, and he could no longer hear the reassuring roar of its guns.

"At Dawn's Early Light!"

Shortly before daybreak, the British guns became silent, and through the smoke-thickened mist of dawn, Key kept a constant vigil in the direction of the battle-scarred Fort. Imagine his elation when he saw dimly but surely the Stars and Stripes waving in proud defiance above the Fort! In the exultation of that sublime moment and aflame with patriotic fervor, Key jotted down on the back of a letter a hasty outline of that stirring tribute to the defenders of Baltimore—an immortal panegyric to the flag of his native land.

Repulsed on land as well as on water, the British troops reembarked and the fleet sailed away. Key returned to Baltimore, where his poem was received with popular acclaim. Hundreds of copies were printed and the words were sung to the tune of "Anacreon in Heaven." The popularity of the song soon became nation-wide, and it was generally accepted as our national anthem. However, it was not until 1931 that Congress gave official recognition to the Star Spangled Banner.

BALOPTICON PROJECTION LANTERN EQUIPMENT

The lanterns and projectors used in the technical sessions at this Meeting have been rented from the Bausch & Lomb Optical Company, Rochester, N. Y.

HOTELS IN BALTIMORE

Room Commitments for Forty-Third Annual Meeting of The American Ceramic Society

Hotel	No. of rooms
Lord Baltimore	400
Emerson	250
Southern	175
Maryland	25
New Howard	50
Belvedere	107

Lord Baltimore

No. of rooms	Rate	
	Single	
40	$ 3.00	
36	3.50	
7	4.00	
		Double
34	3.50	$5.00
53	3.50	5.50
36	4.00	6.00
40	4.50	6.50
8	5.00	7.00
3	6.00	8.00
	Twin	
8	5.50	
26	6.00	
16	6.50	
48	7.00	
8	7.50	
5	8.00	
8	8.50	
	Single or double	
4 (2 suites)	11.00	
20 (10 suites)	15.00	
400		

New Howard

No. of rooms	Twin beds (bath)
5	$6.00
10	5.50
	Double beds (bath)
25	5.00
10	4.50
50	

Belvedere Hotel*

No. of rooms	Rate	
	Single	Double
6	$ 3.50	$ 5.50
6	4.00	6.00
11	4.50	6.50
20	5.00	7.00
		Twin beds
14		7.00
22		8.00
10		9.00
	Parlor suites (twin beds)	
6	10.00	10.00
1	12.00	12.00
2	15.00	15.00
2	16.00	16.00
1	18.00	18.00
	Twin connecting	
	Three persons	Four persons
6	10.00	12.00
107		

* All rooms, private bath.

Southern Hotel

No. of rooms	Rate
	Single (shower)
15	$ 3.00
10	4.00
10	5.00
	Single (tub)
5	5.00
5	6.00
	Double, court (shower)
25	5.00
	Double, outside (shower)
20	6.00
	Double, outside (tub)
10	7.00
	Double, outside (tub, shower)
15	8.00
	Double, corner (tub)
10	9.00
	Twin (shower)
10	6.00
	Twin (tub)
10	7.00
	Twin (tub and shower)
20	8.50
	Twin, corner (tub, shower)
5	9.50
	Large (tub, 3 or more in room)
5	3.50
175	

Maryland Hotel

No. of rooms	Single	Double
	Double bed (no bath)	
5	$2.00	$3.50
		Twin beds (no bath)
5		4.00
	Double bed (bath)	
5	2.50	4.00
5	3.00	4.50
		Twin beds
5		5.00
25		

The Emerson

No. of rooms	Rate	
	Suites	
10	$15.00	
	Twin bedrooms	
75	6.00	
	6.50	
	7.00	
	8.00	
15	5.00	
	Single corner (for 1)	
10	5.00	
	Single	Double (double bed)
75	4.50	6.50
	Single	Double (double bed)
65	3.50	5.00
250		

PROGRAM OF LADIES' ENTERTAINMENT

Sunday, March 30: Ladies' Tea

In connection with the tea, the Committee has arranged a drawing of prizes which will be selected to represent each Division of The Society, namely, Art, Enamel, Glass, Materials and Equipment, Refractories, Structural Clay Products, and White Wares.

This prize-drawing will take the place of the prizes usually offered at the traditional card party, which is excluded at this Meeting.

Monday, March 31: Bus Trip

Bus trip to historical points in Baltimore, including Fort McHenry, the birthplace of the "Star Spangled Banner," the Shot Tower, and The Johns Hopkins Hospital.

Tuesday, April 1: Bus Trip

Bus trip to the Walters Art Gallery and the Baltimore Museum of Art.

The Walters Art Gallery contains the finest collection of art objects in the world. The Baltimore Museum of Art has been built only recently, but nevertheless some very fine pieces of art are on display here.

Wednesday, April 2: Bus Trip

Bus trip to historic Annapolis, the capital of the State of Maryland, including a visit to the Naval Academy.

—RUTH H. ROCHE, *Chairman, Ladies' Committee*

EDWARD ORTON, JR., MEMORIAL LECTURE

Colloid Chemistry in Ceramics

Monday, March 31, 1941: 10:40 A.M.

BY E. A. HAUSER: Colloid Chemistry Division, Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

As introduction, a brief definition of the colloidal state of matter and the scope of colloid chemistry in general are given. The properties peculiar to matter in the colloidal state are emphasized, and the reasons for their existence are explained with special emphasis on those factors which control the stability of suspensions.

This is followed by a general discussion of the chemical composition and mineralogical classification of the more important clay minerals as well as their intimate structure evaluated from X-ray diffraction studies.

The ultimate building units of all clay minerals are discussed. The types of bonds which hold the different atoms of such "building units" together are explained, and their configuration or structure is built up during the lecture in the form of molecular models. This has been made possible by the use of an entirely new, simple, quick and inexpensive method. The formation of simple silicate chains and sheets and the various possible combinations with building units containing aluminum or magnesium is demonstrated, and the differences in properties to be expected from the various possible combinations are explained.

Finally, the properties of the clay minerals most important in ceramics are correlated to their chemical composition and structure, thereby emphasizing the value of systematic colloid chemical research for any fundamental progress of ceramics in the future.

CERAMIC EDUCATIONAL COUNCIL PROGRAM

Sunday, March 30, 1941: 2:00 P.M.

M. E. HOLMES, PRESIDENT

(1) Minutes of Last Meeting: P. G. Herold, *Secretary.*
(2) Report of Committee on Percentage Distribution of Courses: C. M. Dodd, *Chairman.*
(3) Report of Committee on Physical Chemistry: J. W. Whittemore, *Chairman.*
(4) Report of Committee on Ceramic Technology Curricula: N. W. Taylor, *Chairman.*
(5) Report of Committee on Post-Graduate Instruction in Ceramics: F. H. Norton, *Chairman.*
(6) Report of Committee on Grade Point Indices: A. S. Watts, *Chairman.*
(7) Report of Committee on Extension Work in Ceramic Education: Edward McNamara, *Chairman.*
(8) Report of Committee on Contents of Ceramic Engineering Courses: C. W. Parmelee, *Chairman.*
(9) Report of Committee on Recommendations of Institute of Ceramic Engineers: A. S. Watts, *Chairman.*
(10) Reports of Other Committees.
(11) Business Meeting: Election of Officers.
(12) Installation of New Officers.

KERAMOS DINNER MEETING

Members of Keramos will hold a dinner meeting in Baltimore, Md., on Monday, March 31, at 6:30 P.M. at the Hotel Longfellow located at Charles and Madison Streets.

—R. F. SHERWOOD, *President of Keramos*

NINTH NATIONAL CERAMIC EXHIBITION AT BALTIMORE MUSEUM OF ART MARCH 29–APRIL 20

Miss Anna Wetherill Olmsted, Director of the Syracuse Museum of Fine Arts, Syracuse, N. Y., will deliver an address at the opening of the Ninth National Ceramic Exhibition at the Baltimore Museum of Art on Friday night, March 28.

Second Circuit for Ceramic Group

The Ninth National, on tour ever since the initial Syracuse showing in October, has been enthusiastically received everywhere. There has been such a demand for the Ceramic Circuit that the group shown at the Golden Gate Exposition during its first year has been sent on a second tour which has included twelve museums in both circuits. (For the 1940–1941 circuit of the National Ceramic Exhibition see *The Bulletin*, p. 454, November, 1940.)

CERAMIC CAMERA CLUB

Exhibit: Mezzanine Floor

All Week

Dinner Meeting: Parlor M

Wednesday, April 2: 6:30 P.M.

GENERAL SESSION

Presiding Chairman: J. L. Carruthers, President, The American Ceramic Society

Lord Baltimore Hotel: Calvert Room

Monday Forenoon, March 31, 1941: 9:30 A.M.–12:30 P.M.

9:30–9:40 A.M.

1. General Secretary's Report

By R. C. Purdy: 2525 North High St., Columbus, Ohio

9:40–10:00 A.M.

2. President's Address

By J. L. Carruthers: Department of Ceramic Engineering, Ohio State University, Columbus, Ohio

10:00–10:15 A.M.

3. Induction of Officers of The Society for 1941–1942

10:15–10:25 A.M.

4. Introduction of officers (old and new) of the Fellows, the Ceramic Educational Council, and the Institute of Ceramic Engineers

10:25–10:40 A.M.

5. Induction of Fellows of The Society Elected in 1941

10:40 A.M.–12:30 P.M.

Edward Orton, Jr., Fellow Lecture

By Ernst A. Hauser: Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

For abstract see p. 83.

GENERAL SESSION ON SILICATE ANALYSIS

Chairman: S. S. Cole, National Lead Company, South Amboy, N. J.

Program under the Auspices of the Materials and Equipment Division

Lord Baltimore Hotel: Florentine Room

Monday Afternoon, March 31, 1941: 2:00 P.M.–5:00 P.M.

1. Report on Cooperative Test of Proposed Tentative A.S.T.M. Standards for Chemical Analysis of Glass

By G. E. F. Lundell: National Bureau of Standards, Washington, D. C.

This report is a discussion of the results obtained in the cooperative analysis of two standard glasses by the proposed A.S.T.M. methods for the Chemical Analysis of Soda-Lime Glass. These methods have been drawn up in response to a request for such methods made by Committee C-14 of the A.S.T.M. Results by standard and routine methods will be included.

2. Infrared as an Analytical Tool: Dehydration of Silicic Acid Derived from Feldspars

By E. W. Koenig: Consolidated Feldspar Corporation, Erwin, Tenn.

The application of infrared radiation to the evaporation and dehydration of silicic acid solutions derived from feldspars has been studied with the view to replacing the present water-bath evaporation and oven-dehydration procedures. An earlier study had been made of the efficacy of single dehydrations of silicic acid from the standpoint of percentage recovery of silica. Comparative data indicate that the proposed procedure is definitely superior in this respect to the one formerly used.

A comparative time-study tabulation is included, which indicates that the proposed procedure is capable of reducing the analytical time to a material extent. The use of the method for the analyses of other silicates is mentioned briefly and a hypothesis is advanced to explain the apparent departure from the previously accepted theory of the mechanics of the dehydration of silicic acid.

3. A Short Volumetric Method for the Determination of Fe_2O_3 in Silicates

By C. M. Nicholson: American Nepheline Corporation, Rochester, N. Y.

A rapid and accurate volumetric method for the determination of iron as Fe_2O_3 in silicates is described. The sample is fused with a mixture of sodium carbonate and borax, and the fusion is dissolved completely in sulfuric acid. The solution is reduced in a Jones reductor and oxidized with ceric sulfate using orthophenanthroline as indicator. Interference by titanium, or other elements reduced by zinc, is avoided by aeration of the solution after reduction. Estimation of titanium by difference is possible. The method is applicable to a wide range of ceramic materials and iron concentrations. Accuracy of the method is indicated by checking values in various standard samples.

4. Decomposition of Refractory Materials in Solution under High Pressure

By J. I. Hoffman: National Bureau of Standards, Washington, D. C.

The determination of sulfur in highly ignited alumina and beryllia will serve as an example of a method in which ceramic materials are dissolved in hydrochloric acid under pressure. The sample to be decomposed and the acid are sealed in a heavy-walled Pyrex-brand tube and heated for a few hours at about 250°C. After cooling, the tube is broken, the material which now is in solution is washed out, and the sulfur is determined in the usual way by precipitating and weighing as $BaSO_4$. The obvious advantage of such a method is that no alkali salts are introduced during the solution of the sample.

5. Discussion on Determination of Silica in Various Refractory Materials

By G. E. Seil: E. J. Lavino & Company, Norristown, Pa.

GENERAL SESSION: SYMPOSIUM ON COLOR

JOINT MEETING WITH INTER-SOCIETY COLOR COUNCIL

Chairman: Woldemar A. Weyl, The American Ceramic Society Committee on Color

Lord Baltimore Hotel: Calvert Room

Monday Afternoon, March 31, 1941: 2:00 P.M.–5:00 P.M.

1. Methods of Designating Color

By Deane B. Judd: *Chairman*, Inter-Society Color Council; National Bureau of Standards, Washington, D. C.

The following topics are discussed:
(1) Definition and attributes of color (the color solid).
(2) Classification of ceramic materials and the version of color solid used for (*a*) transparent, (*b*) translucent, and (*c*) opaque materials.
(3) Tristimulus specifications from spectrophotometric measurement and the standard colorimetric observer.
(4) Designation of color according to systematically arranged material standards.

2. Spectrophotometry of Ceramic Materials

By F. H. Emery: Harshaw Chemical Company, Cleveland, Ohio

(1) Spectrophotometry is of value in the study of ceramic materials not only in providing data which may be transformed by computation to tristimulus specifications of color but which will also indicate the physical nature of the colorants used. (2) The available spectrophotometers are discussed with particular emphasis given to photoelectric devices. (3) Representative spectrophotometric curves will be shown of ceramic materials.

3. Reflectometry and Filter Photometry of Ceramic Materials

By B. J. Sweo: Ferro Enamel Corporation, Cleveland, Ohio

(1) Instruments which give direct measurements of the transmission or reflection of ceramic samples are widely used to obtain partial color specifications of the samples. A study of the instruments employed and their use are given. (2) The use of additional filters in such instruments for abridged spectrophotometry is mentioned. (3) Tristimulus colorimetry is discussed.

4. Color Standards for Opaque Ceramic Materials

By Campbell Robertson: E. I. du Pont de Nemours & Company, Incorporated, Perth Amboy, N. J.

The topics to be discussed are (1) The Munsell system and its arrangement of colors (also ISCC–NBS method of designating colors and the possible uses of this method in ceramics). (2) The Maerz and Paul Dictionary, the Ostwald system, the British Color Council system, and others. (3) Use of actual ceramic specimens as standards for color.

5. System for Color Measurement in Readily Visualized Form

By Randal M. Robertson and Lowell H. Milligan: Norton Company, Worcester, Mass.

A system has been developed by which color measurements may be expressed and interpreted in readily visualized form. These measurements are taken with the Hunter multipurpose reflectometer using amber, green, and blue tristimulus filters, or with some other instrument whose relationship to the Hunter reflectometer is known.

The new system gives numerical values for a "lightness number," representing visual lightness or darkness, and two chromaticity numbers, consisting of a "yellowness" number and a "greenness" number. Negative values of yellowness may be called blueness, and negative values of greenness may be called purpleness. Intermediate colors may be visualized readily from their actual color numbers.

In this system, there are numerical chromaticity numbers representing the elementary color circle of complementary colors, opposite colors of which, in the form of colored light, may be mixed to give white or gray corresponding to a neutral gray at the center of the color circle. These colors and their various shades and tints are given as numerical data measured by a quantitative instrument. With relatively little practice, the appearance of a color, the approximate "color difference" between two colors, etc., may be visualized from these data. Conversely, the three color numbers corresponding to a color may be estimated semiquantitatively merely by visual observation for comparison with other color number data.

A system is thus established, bridging the gap between the more or less abstract color measurements of the psychophysicist and the common-sense color intuition of the layman.

6. Measurement and Designation of Small Color Differences

By Isay A. Balinkin: Cambridge Tile Company, Cincinnati, Ohio

Quantitative methods of measuring and of designating color differences are still in the process of development, but what has been accomplished thus far can be told. What are fair color tolerances? How may tolerances be practically expressed?

ART DIVISION PROGRAM

Chairman: H. S. Nash, University of Cincinnati, Cincinnati, Ohio
Secretary: C. C. Engle, United Clay Mines Corporation, Trenton, N. J.

Program Committee
W. A. Weldon, Chairman, 621 Edgewood Street, Baltimore, Md.
Carlton Atherton, 1160 East Broad Street, Columbus, Ohio
J. P. Thorley, Parkway, East Liverpool, Ohio

Lord Baltimore Hotel: Parlor M

Tuesday Forenoon, April 1, 1941: 9:30 A.M.–12:00 M.

1. Functional Design

By Charles M. Harder: Department of Ceramic Art, New York State College of Ceramics, Alfred, N. Y.

2. Objectives of Creative Potters

By Marion L. Fosdick: Department of Ceramic Art, New York State College of Ceramics, Alfred, N. Y.

3. Women's Clubs and Ceramic Art

By Anna Lane Dixon: 815 North 4th Street, Burlington, Iowa

4. Organizing a Summer Ceramic Conference

By Kenneth E. Smith: Newcomb College, New Orleans La.

5. Cooperative Ceramics

By L. E. Barringer: General Electric Company, Schenectady, N. Y.

6. University of Pittsburgh Ceramic Course and Its Objectives

By J. P. Thorley: University of Pittsburgh, Pittsburgh, Pa.

WALTER'S ART GALLERY

World-Famous Ceramic Art Collection

Tuesday Afternoon, April 1, 1941: 2:00 P.M.

ART DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Parlor M

Wednesday Forenoon, April 2, 1941: 9:00 A.M.–12:00 M.

7. Clay Bodies for Art Purposes

By C. C. Engle: United Clay Mines Corporation, Trenton, N. J.

8. Notes on Casting

By G. W. Phelps: United Clay Mines Corporation, Trenton, N. J.

9. Fine Use of Pattern

By Carlton Atherton: Department of Fine Arts, Ohio State University, Columbus, Ohio

10. Clay Sculpture

By Paul Bogatay: Department of Fine Arts, Ohio State University, Columbus, Ohio

11. Miniature Pottery and Its Potting

By Margaret Fetzer: Department of Fine Arts, Ohio State University, Columbus, Ohio

12. Creative Experiments with Deaired Clay

By Arthur E. Baggs: Department of Fine Arts, Ohio State University, Columbus, Ohio

13. Design and Production of Dinnerware for Nursery Schools

By Paul G. Herold and Stuart Dods: Department of Ceramic Engineering, Missouri School of Mines and Metallurgy, Rolla, Mo.

A description of raw materials and methods used in the production of earthenware for WPA nursery schools is given. Factors affecting design and decoration of such ware are discussed, together with the solution to the problem as worked out by the cooperating Missouri projects.

BALTIMORE MUSEUM OF ART

(1) Ninth National Ceramic Exhibition; (2) Early Chinese Ceramic Art; and (3) Maryland State Artist Exhibition: Painters, sculptors, and etchers at work

Wednesday Afternoon, April 2, 1941: 2:00 P.M.

ART DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Parlor M

Thursday Forenoon, April 2, 1941: 9:00 A.M.–12:00 M.

14. Symbolism in Chinese Porcelain Decoration

By Chao Ming Chen: 339 East 29th Street, Baltimore, Md.

Mr. Chen, who is from Foochow, China, established his business in the United States in 1920. He has made a lifetime study of Chinese ceramic art, and collectors visit his shop from all parts of the country.

15. Ceramic Craftsman in Today's Market Place

By Emmett White: Baltimore, Md.

Mr. White's name is well known throughout this country in the gift-shop trade. He is a designer and producer of metal and ceramic art objects of good taste.

16. Concepts of Art Expression Contributed by Contemporary Painters

By Clara K. Nelson: Department of Ceramic Art, New York State College of Ceramics, Alfred, N. Y.

17. Research Problems in an Archeological Ceramic Laboratory

By Frederick R. Matson: Michigan State Museum, University of Michigan, Ann Arbor, Mich.

18. Examination of a Chinese Temmoku Glaze and Body

By W. H. Earhart: 42 Orchard Lane, Columbus, Ohio

Using a fragment of authenitic temmoku ware with "hare's fur" glaze, a microscopic examination of the body and glaze was made. The results of a qualitative spectrographic analysis of the glaze chipped from the body is also reported. The probable method of producing this ware is discussed.

ART DIVISION PROGRAM

LOCKE INSULATOR PLANT

Tunnel and muffle kilns, vacuum mills, throwing, and large and small casting

Thursday Afternoon, April 3, 1941: 2:00 P.M.

FREER ART GALLERY, WASHINGTON, D. C.

(Thirty or more required for bus trip)

Friday Forenoon, April 4, 1941: 9:00 A.M.–12:00 M.

POTTER'S ROUND TABLE

Baltimore Museum of Art

Lecture and Demonstration of Pottery Making

Friday Evening, April 4, 1941: 8:00 P.M.

ENAMEL DIVISION PROGRAM

Chairman: J. D. Tetrick, R. & H. Chemicals Dept., Ceramic Division, E. I. du Pont de Nemours & Co., Inc., Perth Amboy, N. J.
Secretary: D. G. Bennett, Mellon Institute, Pittsburgh, Pa.

Program Committee
R. L. Fellows, Chairman, Chicago Vitreous Enamel Product Company, Cicero, Ill.
C. H. Commons, Jr., Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.
F. L. Michael, General Electric Company, Erie, Pa.

Lord Baltimore Hotel: Florentine Room

Tuesday Forenoon, April 1, 1941: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

1. Solubility of Zirconia in Soda-Borosilicate Glasses

By Burnham W. King, Jr., and Andrew I. Andrews: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The solubility of zirconia at 1500°F. and at 2200°F. was determined for glasses containing Na_2O, B_2O_3, Al_2O_3, and SiO_2. The solubility at the same temperatures was also determined for glasses containing equal parts of boric oxide and silica and one or more of the following constituents in quantities of 10, 20, or 30%: Li_2O, Na_2O, K_2O, MgO, CaO, SiO_2, BaO, ZnO, Al_2O_3, CaF_2, and Na_3AlF_6.

10:00–10:30 A.M.

2. Development of Opacity in Zirconia Enamels

By Burnham W. King, Jr., and Andrew I. Andrews: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

Opaque zirconia-bearing enamels are divided as follows into two general types: (1) those whose opacity is due to the undissolved residue of the zirconia added in the raw batch, and (2) those whose opacity is due to the crystallization of a zirconia compound during firing. Illustrations of the different types and the quantity, identity, and appearance of the materials causing opacity in representative samples of each group of enamels are given.

10:30–11:00 A.M.

3. Comparison of Antimony- and Zirconium-Bearing, Cover-Coat White Enamels

By M. J. Bahnsen and H. P. Davis: Ferro Enamel Corporation, Cleveland, Ohio

The properties of these two types of enamels are discussed. Emphasis is placed on the difference in the mechanism of opacification and the effect of variation in firing on the reflectance and color.

11:00–11:30 A.M.

4. Observations of Enamel Strength

By E. W. Dietterle: Century Vitreous Enamel Company, Chicago, Ill.

Ground-coat enamel was applied to strips on one side of 20-gauge, sheet-steel enameling stock, and the strength of the enamel was determined by cross bending for variations of enamel thickness and firing time and temperature. The sheet-steel strips were first tested in cross bending, up to the yield point, before these strips were enameled. The difference between the after and before cross-bend values gave the strength of the enamel under the various testing conditions. The enameled strips, on one side only, were tested in tension and compression, respectively.

11:30 A.M.–12:00 M.

5. Relation of Coefficient of Expansion to Impact Resistance of Porcelain Enamels

By Roger L. Fellows and P. M. Wheeler: Chicago Vitreous Enamel Product Company, Cicero, Ill.

By means of the test procedure of the tentative standard impact test adopted by the Porcelain Enamel Institute, cylinders, coated with several experimental and commercial enamels, were tested and compared. The important facts noted were the effect of cubic thermal expansion on the resistance, the importance of the ground coat to the resistance of any one cover enamel, and the wide variation between cover enamels in resistance to impact.

ENAMEL DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Florentine Room

Tuesday Afternoon, April 1, 1941: 2:00 P.M.–5:00 P.M.

2:00–2:30 P.M.

6. Effect of Variations in Firing Treatment on Physical Properties of Dry-Process Enamels

By R. R. Danielson and Perry McCollom: Metal & Thermit Corporation, Carteret, N. J.

Studies have been made on the effect of varying firing treatment on the properties of dry-process enamels, including reflectance, acid resistance, and the resistance to surface abrasion and staining.

2:30–3:00 P.M.

7. Advantages of Treated Water in the Enamel Industry

By N. H. Stolte: Davidson Enamel Company, Clyde Ohio

A method of treating a very hard water for use in the pickle room and mill room is described. The reactions taking place during purification and the method of regeneration are given. The cost of operation and advantages of the use of treated water are discussed.

3:00–3:30 P.M.

8. Study of Changes of Physical and Chemical Properties of a Cleaner Bath with Use

By J. M. Zander: Chicago Vitreous Enamel Product Company, Cicero, Ill.

This study constitutes an investigation of the changes that occur in some of the initial physical and chemical properties of an alkaline cleaner bath with use. Consideration is given not only to the effect of the cleaning of ware over a period of time on such properties of a cleaner bath solution as pH, specific gravity, chemical activity, and composition but also to a possible correlation of these changes with respect to cleaner bath efficiency. The data presented indicate a continual change in the initial properties of the cleaner bath solution, but the trend of the changes is not necessarily progressive in the same direction. An analysis of the curves and photographs showing the changes in properties also reveals a common point which is probably significant of a radical change in the cleansing ability of a cleaner bath.

3:30–4:00 P.M.

9. Recent Chemical Ideas in Handling Porcelain Enameled Sheets

By D. J. Benoliel: Quaker Chemical Products Corporation, Conshohocken, Pa.

An outline of the theory and facts is presented on the proper oiling of sheet steel for shipment from the mill. Recent work tends to show easier cleaning and more rapid pickling when this is done.

A study on various types of fats used in drawing is reviewed as well as the unsuitability of some compounds because of difficulties in cleaning and metal finishing. New chemicals and methods are presented for pre-cleaning ware before it reaches the pickle room, utilizing wetting agents and solvents.

Pickle-room troubles and the extent of the liability of the alkaline cleaner used therein are discussed, and suggestions are given on emulsifiers, wetting agents, and soaps used in alkaline cleaners, with particular stress on their misuse in many places.

4:00–4:30 P.M.

10. Application of Novel Method of Measuring Set to the Solution of Ground-Coat Dipping Problems

By H. L. Cook and C. H. Wolff: The O. Hommel Company, Pittsburgh, Pa.

Of all the operations that are performed in the enameling shop, the one that is most difficult to control and which has to be done by "cut-and-try" means is the setting up of enamels for dipping. This difficulty occurs because there has been no practical accurate method for measuring the set of the enamel. Practical experience indicates that viscosity is no sure guide to the set or the dipping weight.

This method, presented at the Toronto Meeting of The Society, is a simple means of determining the set or yield value of the enamel. It is accomplished by determining the apparent specific gravity of the enamel slip with a suitable hydrometer and by comparing that with the true value for the specific gravity. Calculations give a numerical value for the value of the set or yield point. The measurements are accurately reproducible, and dipping weights have been found to correlate quite well with the set or yield point. The results are given of tests in laboratory and plants.

4:30–5:00 P.M.

11. The New Enamel Bibliography Being Published by the Enamel Division

By J. E. Rosenberg: The O. Hommel Company, Pittsburgh, Pa.

The work of compiling the Bibliography has been completed. The discussion will give an outline of the scope of the work and plans for future editions.

ENAMEL DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Florentine Room

Wednesday Forenoon, April 2, 1941: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

12. Surface Defects on Sheets and Their Effect on Enameling

By John A. Eckel and Peter A. Reynolds: Carnegie-Illinois Steel Corporation, Gary Sheet Mill, Gary, Ind.

A description, together with photographs, is presented of the more common surface defects found on continuous-mill enameling sheets. Proper nomenclature for these defects and how they perform under enameling conditions are given.

10:00–10:30 A.M.

13. Hydrogen in Enameling Stock

By C. A. Zapffe: Battelle Memorial Institute, Columbus, Ohio

An extension of earlier work is presented to clarify some aspects of hydrogen in enameling stock and to convey to enamelers recent developments regarding hydrogen in steel. Hydrogen analyses, made by a modified vacuum-fusion technique, are given to show the principal periods and fluctuations of hydrogen absorption and desorption by the steel base during ordinary enameling procedure. The phenomenon of reboiling is given particular attention, and the behavior of different steels is discussed from the standpoint of microstructure, macrostructure, type of fabrication, and heat treatment relating to their effect on hydrogen occlusion and diffusion. An important role in reboiling, played by the surface condition of the enameling stock as received from the mill, is identified. Recommendations are made for preventing the occurrence of hydrogen-caused defects.

10:30–11:00 A.M.

14. Investigation of Fish-Scale Phenomena

By W. W. Higgins and W. A. Deringer: A. O. Smith Corporation, Milwaukee, Wis.

Some of the characteristics of fish scaling are discussed, and it is established that fish scaling is accompanied by the evolution of gas.

Three factors which were believed to influence the tendency to fish scale were investigated. (1) *Base metal:* The metallurgy of the steel and the effect of cold working on steel is explored. (2) *Clay in the enamel:* The effects of various types of clays on fish scaling are considered. (3) *Furnace atmosphere:* The effects of various furnace atmospheres are investigated.

11:00–11:30 A.M.

15. Fish Scaling and Chipping

By C. A. Zapffe and J. L. Yarne: Battelle Memorial Institute, Columbus, Ohio

Additional proof is added to that of earlier work to show that hydrogen effusing from the enameled sheet is the cause, probably without important exception, of chipping phenomena (aside from mechanical mishandling). The physical differences of the defects are shown to be caused by differences in the enamel and in the nature of the gaseous effusion. Fracture of the enamel by the gas thus may vary in appearance from the minute "shiner" through the "process fish scale" and the larger fish scale, the "jumper" and chip, finally to the platelike defect that bares large surfaces of the metal and suggests poor adherence. Important functions of the oxide layer, effects of pretreatment of the steel and type of steel, and the absorption of hydrogen from the slip during firing, are discussed and illustrated by experiment. The relation of fish scaling to reboiling is established, thereby proving that both phenomena are primarily hydrogen functions. Hydrogen analyses are presented to show that the behavior of enameling stock in its relation to fish scaling conforms to the hydrogen theory and to the postulates presented in the earlier studies.

11:30 A.M.–12:00 M.

16. Scratch Blisters

By C. A. Zapffe and J. L. Yarne: Battelle Memorial Institute, Columbus, Ohio

The occasional occurrence in industry of blisters overlying scratchmarks on the underlying steel sheet is shown to be connected with hydrogen contained in the steel. The action of the gas is similar to that in causing various defects along the edges of enameled ware. The principal sources of that hydrogen are investigated, and it is shown that "scratch blisters" can be obtained or avoided at will by controlling the type of scale on the sheet and the hydrogen absorption by the sheet during preparation for enameling. Variation in the type of scale on commercial sheet is found to be the controlling factor in industrial occurrence of the defect. Electrochemical effects occurring during cleaning by pickling are discussed, and some relations of the nickel-dip process to production of scratch blisters are demonstrated.

Enamel Division Luncheon and Business Meeting
Lord Baltimore Hotel: Florentine Room
Wednesday Noon April 2, 1941: 12:00 M.–2:00 P.M.

ENAMEL DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Florentine Room
Wednesday Afternoon, April 2, 1941: 2:00 P.M.–5:00 P.M.

2:00–2:30 P.M.

17. Moving Pictures of Enamel Defects

By Andrew I. Andrews: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

Moving-picture micrographs will be shown of the actual occurrence of tearing, fish scaling, reboiling, blistering, and copperheading.

2:30–3:00 P.M.

18. Iron Oxide in Enamel Glass as Dissolved from the Metal Base

By Andrew I. Andrews and H. R. Swift: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The iron oxide content of an enamel glass was measured by the use of a predetermined curve, iron oxide vs. index of refraction. The iron content of the glass at the interface between the enamel and the iron rises sharply in the early stages of firing to a value close to the solubility limit of the glass, after which it gradually falls to a constant value. At the surface, the iron content remained low until that at the interface decreased, whereas the former correspondingly increased. Cobalt additions resulted in a lower iron content in solution at the interface but increased the dendrite content of the glass; a decrease in the cobalt resulted in the opposite effect. There was a direct relation between the amount of cobalt, the amount of dendrites, and the adherence. The effects of temperature and thickness of application are given, and the results are discussed.

3:00–3:30 P.M.

19. Observations on Effect of Iron Oxide on Tensile Strength of Porcelain Enamel Sheet-Iron Ground Coat

By A. M. Johnsen and J. J. Canfield: American Rolling Mill Company, Middletown, Ohio

This investigation was conducted for the purpose of determining whether iron oxide affected the tensile strength of enamel. The results indicate that ferric oxide appreciably reduces the enamel strength and ferrous oxide may have an even greater effect. The possible relation of chipping of the enamel to the iron oxide content is noted.

3:30–4:00 P.M.

20. Cause of Pinholes and Some Related Defects in Enamel Coatings on Cast Iron

By C. A. Zapffe and C. E. Sims: Battelle Memorial Institute, Columbus, Ohio

Earlier confusion in identifying hydrogen as the predominating cause of certain defects in enamel on cast iron is shown to be due largely to the close association of carbon and hydrogen in cast iron and steel. The principal relation of carbide and graphite to enameling defects is the release of hydrogen from the carbon during enamel firing. The much-discussed "chill layer" therefore is important chiefly because this layer often contains hydrogen that is bound to the carbon in the cementite. Experiments show that regardless of the depth or nature of the surface chill no pinholing or blistering results during firing at 725°C. when hydrogen is absent.

Sources of the hydrogen that causes the defacement are found chiefly in melting and in casting. The low oxygen pressure of molten cast iron favors hydrogen absorption. Moisture in the atmosphere, in the charge, or chemically combined in the rust on scrap provides the greatest quantities of the gas, and moisture and organic materials in the mold are also prolific sources of hydrogen for absorption by the iron. At ordinary temperatures, rusting is often harmful.

Flushing the melt with a dry, hydrogen-free gas, such as nitrogen, removes the dissolved hydrogen, and defects during subsequent enameling will not occur unless hydrogen is obtained later from other sources. Chipping phenomena probably are caused chiefly by hydrogen effusion, just as are analogous defects in sheet-steel enameling.

4:00–4:30 P.M.

21. General Description of an Automatic Enameling Furnace Designed for Controlled Oxidation Firing

By W. G. Martin: A. O. Smith Corporation, Milwaukee, Wis.

A description is given of a unique enamel firing furnace designed to make use of the controlled oxidation firing process. There is a brief discussion of the problems dictating the design, and the special atmosphere generator is described.

4:30–5:00 P.M.

22. Molybdenum in Enamels: II, Adherence Produced with Soluble and Insoluble Molybdates

By Karl Kautz: Climax Molybdenum Company of Pennsylvania, Langeloth, Pa.

This investigation reports experiments made with molybdenum trioxide, ammonium molybdate, sodium molybdate, calcium molybdate, barium molybdate, and lead molybdate as mill additions. The properties of these compounds and their behavior as mill additions, with or without the addition of antimony compounds, are given. Typical smelter batches and mill batches are included.

ENAMEL DIVISION PROGRAM (concluded)

Lord Baltimore Hotel: Florentine Room

Thursday Forenoon, April 3, 1941: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

23. Relation of Particle Sizes of Frit and Color Oxides to Color Properties of Porcelain Enamels

By Andrew I. Andrews and Ralph L. Cook: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The effects of variations in the particle size of a typical green and a typical blue color stain in sized fractions of a representative clear frit were studied. Microscopic examinations were made of the sized fractions, and photomicrographs of the respective fields are presented. The color characteristics of the enameled panels were determined on a continuous recording spectrophotometric photometer. It was found that a frit particle, 45 to 75μ, in combination with a color particle of less than 5μ, gave the optimum color characteristics. It was further indicated that color particles larger than 5μ seriously impaired the resulting color.

10:00–10:30 A.M.

24. Porcelain Enamel as a Protective Coating for Hot-Water Tanks

By D. R. Goetchius: Ferro Enamel Corporation, Cleveland, Ohio

The suitability of both zinc and porcelain enamel as protection for water storage tanks is discussed giving test methods and results of simulated service tests.

10:30–11:00 A.M.

25. Use of Liquid Surfaces as Standards of Specular Gloss

By Dwight G. Moore and Richard S. Hunter: National Bureau of Standards, Washington, D. C.

It is possible to flow a film of any one of several liquids on the rough ground or sandblasted face of a black ceramic body and use the surface of the film as a standard of specular gloss. The specular gloss of the film may be computed from the angle of reflection and the refractive index of the liquid by means of the Fresnel equation. The technique described was developed for use with the Hunter multipurpose reflectometer to avoid the inaccuracies of specular gloss measurements which result when the polished black-glass surfaces heretofore employed as working standards become abraded in use.

11:00–11:30 A.M.

26. Examples of Color Measurement with the Multipurpose Reflectometer and Tristimulus Filters

By Richard S. Hunter: National Bureau of Standards Washington, D. C.

Used with tristimulus filters, the multipurpose reflectometer will compare the colors of pairs of spectrally similar specimens. (R. S. Hunter, "Multipurpose Photoelectric Reflectometer," *Jour. Research Nat. Bur. Stand.*, **25,** 581–618 (1940); R.P. 1345; also in *Jour. Opt. Soc. Amer.*, **30,** 536 (1940).) Examples will be shown of the application of the instrument to such specimens for the measurement of (1) ICI trilinear coordinates, x and y; (2) uniform-chromaticness-scale trilinear coordinates, α and β; (3) amount of color difference between two specimens, ΔE; (4) whiteness, W; and (5) yellowness, Yel. The types of measurements for (4) and (5) are used chiefly for near-white specimens.

When, however, the specimens compared are spectrally dissimilar, errors result from the spectral disparity between the ICI standard observer and the source-filter-photocell combinations used in the instrument. It is therefore necessary sometimes to make a preliminary study of a problem to discover whether these errors are important; in spite of this limitation, the reflectometer, with filters in their present stage of development, has been found to provide the most rapid method of color measurement available for many problems.

11:30 A.M.–12:00 M.

27. Montmorillonite as a Substitute for Bentonite in Enamel Slips

By Frank Zvanut: Ferro Enamel Corporation, Cleveland, Ohio

A clean white montmorillonite from Texas is being used in place of bentonite with excellent results in cover-coat and ground-coat enamels. Among its advantages are extreme purity, uniformity of set on aging, and freedom from blistering in antimony-free enamels.

12:00–12:30 P.M.

28. An Instrument for Studying the Fine Texture of Ceramic and Other Surfaces

By F. W. Adams, Lee Devol, and H. R. Letner: Mellon Institute, Pittsburgh, Pa.

The fine texture of various hard surfaces may be readily measured using a tracing point and optical lever in a profilograph of new design. Variations of 0.000001 in. can be detected in the surface and topographic or relief maps can be prepared at magnifications up to 6000×. The high accuracy is obtained with no more difficult machine work than the simultaneous lapping of two tapered bearings mounted on the same shaft. By supporting the tracing point and its mirror on torsion elements of special design, the instrument is rendered relatively insensitive to vibration and given an unusually high resolving power. The kind of results obtained is illustrated by profilograms of chalkboards having various writing and erasing characteristics and by a topography of a ground glass surface. (Samples of the chalkboard surfaces will be shown.)

GLASS DIVISION PROGRAM

Chairman: W. R. Lester, Maryland Glass Corporation, Baltimore, Md.
Secretary: S. R. Scholes, Department of Glass Technology, New York State College of Ceramics, Alfred, N. Y.

Program Committee

A. K. Lyle, Chairman; Hartford-Empire Company, Hartford, Conn.
W. C. Taylor, Corning Glass Works, Corning, N. Y.

Lord Baltimore Hotel: Calvert Room

Tuesday Forenoon, April 1, 1941: 9:30 A.M.–12:00 M.

9:30–9:55 A.M.

1. Effect of Light on the Color of Iron-Bearing Glasses

By A. E. Badger and A. Ottoson: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

Various glasses containing small amounts of iron oxide were exposed to light from a carbon arc and from a quartz-mercury arc and also to sunlight and X rays. A study was made of the color changes that occurred, using a spectrophotometer.

10:00–10:20 A.M.

2. New Methods of Cleaning Glass Sands

By John Dasher and Oliver C. Ralston: Nonmetals Division, U. S. Bureau of Mines, College Park, Md.

A discussion is presented of the various forms of iron-bearing impurities in glass sands and methods for the removal of each type of impurity, with emphasis on the attrition scrubber, froth flotation, and agglomeration. The equipment and operating items that make up costs are listed, and detailed results of various treatments on different sands are included.

10:25–10:50 A.M.

3. Effect of Storage Conditions on Weathering and Chemical Durability of Commercial Glass Containers

By J. S. Owens and E. C. Emanuel: Armstrong Cork Company, Lancaster, Pa.

Flint bottles of different chemical compositions were stored empty, capped and uncapped, for periods up to twelve months at (1) 100°F., 80% relative humidity; (2) 130°F., 10% relative humidity; and (3) normal room temperature and humidity. The effect of storage was determined by visual examination and by tests of the alkali extraction by water at 50° and 120°C. Photomicrographs of weathered bottle surfaces were made. Important factors in the weathering and chemical durability of empty, commercial glass containers stored under these conditions are discussed.

10:55–11:05 A.M.

4. Factors Influencing Autoclave Chemical Durability Tests of Glass Containers

By A. Herman: Joseph E. Seagram & Sons, Incorporated, Seventh Street Road, Louisville, Ky.

Various factors affect the results obtained in the autoclave chemical durability tests, such as the time and temperature of extraction and impurities in the distilled-water leaching medium. These factors are discussed with particular emphasis given to distilled-water impurities. Glass containers of a wide range of durability were tested, using water containing various known impurities. The effects on the results are listed in tables. Conclusions are drawn as to the degree of standardization of time, temperature, and purity of distilled water necessary to obtain uniform results with the test.

11:10–11:30 A.M.

5. Investigation of Variable Factors in Accelerated Autoclave Chemical Durability Tests

By J. S. Owens and E. C. Emanuel: Armstrong Cork Company, Lancaster, Pa.

An investigation was made of certain factors which influence the reproducibility of autoclave chemical durability tests. These factors include the method of prepara-

tion and the purity of the water used, the rinsing procedure, the volume of solution used, and variations in the test temperature and in the duration of the different periods of the heat cycle. The effect of the internal area of the container on the test result was determined, and suggestions are presented for increasing the reliability of the tests.

11:35 A.M.–12:00 M.

6. Method of Testing Surface Alkalinity of Glass Bottles

By A. J. Liebmann and M. Rosenblatt: Schenley Distillers Corporation, 350 Fifth Avenue, New York, N. Y.

(1) A description is given of a reliable and reproducible analytical method for testing the small amount of alkali derived from the glass by titration. (2) The magnitude and type of extraction of various commercial glasses by neutral alcoholic liquids during the accelerated test is determined, and a method of sealing alcoholic liquids in bottles during tests run above the boiling point is described. (3) The conditions of the test are determined for extracting alkali of the same order of magnitude as in (2), using water as a leaching medium. (4) A correlation of the results on accelerated tests with visible flaking phenomena is presented. (5) The effect of the size of the glass container on the magnitude of extraction is noted.

Glass Division Luncheon and Business Meeting

Lord Baltimore Hotel: Calvert Room

Tuesday Noon, April 1, 1941: 12:30 P.M.–1:45 P.M.

GLASS DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Calvert Room

Tuesday Afternoon, April 1, 1941: 2:00 P.M.–3:55 P.M.

2:00–2:30 P.M.

7. Analysis of Gases Dissolved in Glass and Gases Present in Seeds

By Hugh A. Shadduck and Arthur Van Zee: Owens-Illinois Glass Company, Toledo, Ohio

The procedure for analyzing gases dissolved in glass is described, and some typical results for flint glass are shown. A brief account of a micromethod for determining gases present in seeds is presented together with some of the data obtained.

2:35–2:50 P.M.

8. Cord Analysis

By J. C. Turnbull: Preston Laboratories, Butler, Pa.

In the separation of fine glass powders according to density differences, greatly improved results are obtained by means of a stroboscopic light so that the position and motion of the glass particles in the suspending liquid can be seen while the centrifuge is in motion. The density spread of the powder and a curve giving the distribution in density may thus be obtained rapidly. This procedure is valuable as a quick check on glass quality.

The technique of obtaining separated samples has been improved, and these samples have been analyzed chemically with interesting results. Generalizations from data up to the present time indicate that the majority of cords in bottle glass, which appear conspicuous and under considerable strain in the polariscope, are batch cords and do not have their origin in aluminous refractory solution.

2:55–3:15 P.M.

9. Formation of Apatites in Opal Glasses and Bone China

By Woldemar A. Weyl: Department of Ceramics, Pennsylvania State College, State College, Pa.

The formation of apatite minerals is discussed, and it is shown that apatites form a phosphate opal glass. On this basis, the characteristic properties of this group of opal glasses can be understood. Suggestions are made to overcome difficulties in the production of phosphate opal glasses, especially those of the heat-resisting type. In connection with this problem, the translucency of bone china is examined.

3:20–3:35 P.M.

10. Phosphate Glasses and Some Characteristic Properties

By N. J. Kreidl and W. A. Weyl: Department of Ceramics, Pennsylvania State College, State College, Pa.

The properties of pure phosphate glasses as base glasses, especially those for colored oxides, are discussed. Considering the influence of alumina on the resistivity of phosphate glasses in many new applications outside the optical field, aluminum-phosphate glasses were studied in various combinations. Glasses containing up to over 90% of aluminum phosphate and no monovalent fluxes, or, in many cases, no bivalent fluxes, could be obtained within the range of normal melting temperatures. The structure of crystalline aluminum phosphate with its striking similarity to the quartz structure offered a significant subject of comparison. The potential uses of glasses and fluxes in the electrical industries are examined in connection with the characteristic properties of aluminum-phosphate glasses. Of other phosphate glasses of similar type, iron-phosphate glass seems to be of primary interest.

3:40–3:55 P.M.

11. Phosphorous Compounds as Reducing and Fining Agents for Glasses

By W. A. Weyl and N. J. Kreidl: Department of Ceramics, Pennsylvania State College, State College, Pa.

The usual fining agents are based on the evolution of oxygen at high temperatures and therefore cannot be applied to glasses to be melted under reducing conditions. Phosphorus and phosphides have been found to be suitable fining agents for heat-absorbing and copper ruby glasses. These agents reduce and fine the glasses simultaneously.

GLASS DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Calvert Room

Wednesday Forenoon, April 2, 1941: 9:30 A.M.–12:00 M.

9:30–9:55 A.M.

12. Effect of (a) Barium Oxide and (b) Zinc Oxide on Physical Properties of a Typical Soda-Dolomite-Lime-Silica Glass

GENERAL RESEARCH LABORATORY, Owens-Illinois Glass Company, Toledo, Ohio

To a base glass containing 14% of sodium oxide, 12% of dolomite lime, and 74% of silica, (1) barium oxide and (2) zinc oxide were systematically substituted for (*a*) Na_2O, (*b*) CaO + MgO, and (*c*) SiO_2 in amounts of 1, 3, and 5%. The effects of these substitutions on such physical properties as liquidus temperature, viscosity, deformation temperature, density, fiber softening point, coefficient of expansion, and the resistance of the glasses to dilute acid and distilled water are presented.

10:00–10:15 A.M.

13. Résumé of Utilization of Flat Glass Products

BY R. A. MILLER: Pittsburgh Plate Glass Company Pittsburgh, Pa.

10:20–11:05 A.M.

14. Summary of Work on Atomic Arrangement in Glass

BY B. E. WARREN: Department of Physics, Massachusetts Institute of Technology, Cambridge, Mass.

The present picture of the atomic arrangement in glass has developed from four kinds of information, namely, (1) laws of crystal chemistry, (2) X-ray diffraction study of glass, (3) various measured physical properties of glass, and (4) kinds of materials and the ranges of composition in which glassforming properties exist. X-ray diffraction studies establish the predominant type of bonding in the glass; for example, the tetrahedral bonding in silicate glasses. Secondary structural features, such as those which change with annealing or conditioning, do not show up in the X-ray pattern. Most of the proposed structures are those (1) which are suggested and partially substantiated by X-ray studies, (2) which fit the laws of crystal chemistry and (3) which seem best able to explain the physical properties of the glass.

The preliminary theory of immiscibility in glass systems has been extended to include a study of the temperature dependence. A consideration of thermal expansion in terms of the number of glassforming bonds allows a simple correlation between thermal-expansion coefficients in the silica-boric oxide and the soda-boric oxide systems. The same kind of considerations as those used in discussing immiscibility may be used to give a quantitative treatment of the change in coordination number of the boron atom when boric oxide is present with soda.

11:10–11:30 A.M.

15. X-Ray Diffraction Studies of Some Soda-Lime-Silica Glasses

BY J. BISCOE: Department of Physics, Massachusetts Institute of Technology, Cambridge, Mass.

Three soda-lime-silica glasses have been studied by the Fourier integral method. The compositions (by weight) are as follows:

SiO_2	CaO	Na_2O
0.683	0.206	0.109
.763	.124	.114
.694	.102	.202

The radial distribution curves of the three compositions are similar. The first, and only, peak which is resolved occurs at about 1.62 a.u. This distance corresponds to the silicon-oxygen distance. The area of the peak indicates that there are four oxygens about each silicon. The remaining peaks on the curves are not resolved. A peak would be expected, however, at 2.65 a.u. corresponding to the distance between oxygens of the same silicon-oxygen tetrahedron. The area of this peak can be calculated from the composition of the glass. A peak would also be expected at about 2.7 a.u. owing to the sodium-oxygen distance. The area of this peak would be expected to correspond to about 6 oxygens around a sodium, as was found in soda-silica glass. If these two peaks are drawn on the radial distribution curves, there remains a peak whose area corresponds roughly to 7 oxygens about a calcium and which occur at about 2.4 a.u.

The interpretation of these distribution curves, although not so unequivocal as were those of the single component or even the binary glasses, leads to the same sort of picture of the atomic arrangement. Each silicon is surrounded by 4 oxygens. Some of the oxygens are bonded to 2 silicons and the remainder to but one. This forms a continuous random network with rather large holes in which the calcium and sodium ions are located.

11:35–12:00 M.

16. X-Ray Diffraction and Physical Properties of Potassium Borate Glasses

BY ROBERT L. GREEN: Research Laboratory, General Electric Company, Schenectady, N. Y.

The data from X-ray studies and from measurements of physical properties of potassium borate glasses in the composition range from 0 to 40% by weight of K_2O are presented. Calculations based on the X-ray diffraction patterns show a change from three- to four-fold coordination with an increase in K_2O content. At a K_2O content of between 20 and 25%, the coefficient of thermal expansion is a minimum, showing that the majority of the boron atoms are in four-fold coordination. The curves of composition versus transformation point, softening point, density, and refractive index show a change in slope in the composition range of 20 to 30% of K_2O.

It is concluded that the random structure picture as well as the tendency for boron atoms to assume tetrahedral coordination in alkaline borate glasses satisfactorily explains both the X-ray diffraction curves and the otherwise anomalous physical behavior of the potassium borate glasses.

GLASS DIVISION PROGRAM (concluded)

Lord Baltimore Hotel: Calvert Room

Wednesday Afternoon, April 2, 1941: 2:00 P.M.–4:00 P.M.

2:00–2:15 P.M.

17. Conditions Encountered During the Filling of Pressure Ware

By John A. Sharf: 2760 Devonshire Place, N.W., Washington, D. C.

Many beverages contain dissolved CO_2 held in solution by pressures above atmospheric. To fill these products nto pressure ware calls for mechanical systems which operate at pressures above atmospheric. The bottles are thus subjected to varying conditions of internal pressure during their filling. Because the ware is usually warmer than the product, there may also be some thermal effect. The action of the filling machine and the closure application also introduces some mechanical loading. The extent and timing of these conditions depend somewhat on the type of filling apparatus, but general limits can be stated to give some consideration as to the service demands on the ware during this particular operation.

2:20–2:35 P.M.

18. Glass Batch Mixing

By Wayne E. Brownell and S. R. Scholes: New York State College of Ceramics, Alfred, N. Y.

Laboratory methods of mixing, sampling, and analyzing batches are discussed. The idea of segregation by continued mixing is shown to be fallacious. The effect of powdered materials is shown as an improvement in the rate and thoroughness of mixing.

2:40–2:55 P.M.

19. Amber Glass and the Role of Carbon

By Henry Moore and S. R. Scholes: New York State College of Ceramics, Alfred, N. Y.

Melting experiments, employing batch materials free from sulfur and pure carbon in the form of sugar, demonstrate that carbon is not retained as a colorant. The value of carbon as a reducing agent in sulfur-bearing batches is confirmed, and the effect of iron is experimentally shown.

3:00–3:15 P.M.

20. Tantalum Glass: K_2O–Ta_2O_5–SiO_2 Series

By K.-H. Sun and Alexander Silverman: Department of Chemistry, University of Pittsburgh, Pittsburgh, Pa.

The partial molal volume and refractivities, based on the Gladstone-Dale and the Lorentz-Lorenz formulas of potassia-tantala-silica glasses, have been evaluated from the experimental data of density and refractive index. Equations and constants are available for the calculation of volume and refractivities from composition, and the density and refractive index may therefore be computed. The interionic distances of Ta-O, Si-O, and K-O, calculated from the refractivity data, agree favorably with known measured values. Tantala, as compared with silica and phosphorus pentoxide, is a poor "network former." The high oxygen-to-tantalum ratio and the relatively large Ta-O distance result in the formation of new singly bonded oxygens and a glass that is loose in structure. The range of composition, which was limited by a fixed melting temperature (1400°C.), extends from 21 to 38% of potassium oxide, 5 to 36% of tantala, and 39 to 71% of silica.

3:20–3:35 P.M.

21. Elastic Aftereffects and Dielectric Absorption in Glass

By Nelson W. Taylor: Department of Ceramics, Pennsylvania State College, State College, Pa.

Von Schweidler's theory of dielectric absorption and Taylor and Doran's theory of the delayed elastic effect in glasses are shown to be mathematically of the same form and to lead to the same conclusions regarding the constitution of glass. They are also in accordance with the "random network" picture of glass as based on X-ray diffraction studies. The intimate relation, in the molecular sense, between the elastic and dielectric phenomena is demonstrated, and an explanation is offered for the "principle of super-position" as applied to these phenomena.

3:40–4:00 P.M.

22. Characteristic Interference Patterns of Plate and Window Glass

By F. W. Adams and P. W. French: Mellon Institute, Pittsburgh, Pa.

A simple laboratory procedure has been developed for quickly distinguishing window glass from plate glass by means of interference patterns with monochromatic illumination. Small samples may be readily identified. Commercial samples of plate and window glass have been examined by this method, and representative patterns are presented.

4:05–4:25 P.M.

23. Improved Methods of Applying and Melting Batch in Glass Tanks

By L. S. Longenecker: Frazier-Simplex, Inc., Washington, Pa.

A brief résumé is given of batch feeding methods, (1) a periodic lump charging, (2) continuous narrow ribbons, and (3) a continuous wide blanket almost the full width of the tank. A study is made of these batch streams through their melting cycle, the gas liberating period; the heat requirement and its source; the efficiency of the surface versus the submerged melting; and the effect on the speed of melting with increased surface exposure of the batch to the flame. The speed of melting may be accelerated by intensifying the flame. The influence of fast batch melting on the fining of glass and the result in improved quality is mentioned, and a report is made on operating results in reference to fast or "flash" melting.

MATERIALS AND EQUIPMENT DIVISION PROGRAM

Chairman: B. T. Bonnot, Bonnot Company, Canton, Ohio
Secretary: S. S. Cole, National Lead Company, Titanium Division, South Amboy, N. J.

Program Committee
S. S. Cole, Chairman
J. R. Kauffman, Allied Engineering Company, Milltown, N. J.
R. Buchholz, Box 466, East Liverpool, Ohio

Lord Baltimore Hotel: Cloak Room

Tuesday Forenoon, April 1, 1941: 9:30 A.M.–12:00 M.

SESSION ON ANALYTICAL PROCEDURES

S. R. Scholes, Presiding Chairman

1. Separation and Determination of Arsenic, Antimony, and Tin in Glass

By G. E. F. Lundell: National Bureau of Standards, Washington, D. C.

A method for the determination of arsenic, antimony, and tin will be described in which the glass is decomposed by treating it with nitric, sulfuric, and hydrofluoric acids. The arsenic and antimony are reduced by treating the sulfate solution with sulfur. After adding hydrochloric acid, the arsenic, antimony, and tin are separated by fractional distillation in an all-glass distilling apparatus. Usually the three elements are determined in the distillates by titration, but small amounts of arsenic are determined colorimetrically.

2. Separation of Lithium from Calcium and Its Determination in Silicate Materials such as Clays and Glass

By J. I. Hoffman: National Bureau of Standards, Washington, D. C.

Determinations of small amounts of lithium in ceramic materials, such as clays, glasses, and feldspars, by the J. Lawrence Smith method are unsatisfactory because some of the lithium is retained by the calcium carbonate when calcium is removed. A satisfactory modification of the Smith method has been developed in which a 3-gm. sample of clay can be handled, and the precipitation of calcium as carbonate is eliminated.

3. Use of the Rarer Oxides in Ceramics

By N. J. Kreidl: Department of Ceramics, Pennsylvania State College, State College, Pa.

The ceramic industries have shown increasing interest in the use of certain oxides which were considered rare only a few years ago. The question of rarity deserves a brief discussion. The characteristic properties of zirconia, thoria, the rare earth oxides, and beryllia are the background of a great number of modern applications in the refractory industries, in glass making, and in the opacification of enamels; many other subjects of interest may be found in the investigation of different special uses.

4. Direct Determination of Iron and Vanadium in Presence of Titanium

By S. S. Cole and C. A. Kumins: Titanium Division, Research Laboratory, National Lead Company, South Amboy, N. J.

Improved accuracy in the determination of vanadium in the presence of iron and titanium was obtained by the use of orthophenanthroline indicator to establish vanadium in tetravalent form. Boiling the solution to destroy the indicator and subsequent titration with $KMnO_4$ gave a sensitivity of ± 0.5 mg. Reduction of vanadium, titanium, and iron by zinc and subsequent oxidation by $KMnO_4$ may give low values owing to slow reduction of vanadium when more than 2 mg. are present. A silver reductor was used for the direct determination of iron.

JOINT MEETING: MATERIALS AND EQUIPMENT AND WHITE WARES DIVISIONS

Lord Baltimore Hotel: Private Dining Rooms D, E, F

Tuesday Afternoon, April 1, 1941: 2:00 P.M.–5:00 P.M.

SYMPOSIUM ON PARTICLE SIZE

S. S. Cole, Presiding Chairman

For abstracts of papers, see White Wares Division Program, p. 106.

5 (9). New Method of Purifying Water for the Ceramic Industry

By W. S. Morrison: Illinois Water Treatment Company, Rockford, Ill.

6 (10). Particle-Size Distribution of Glazes

By J. H. Koenig and F. C. Henderson: Hall China Company, East Liverpool, Ohio

7 (11). Some Practical Aspects of Particle-Size Control

By S. C. Lyons: Georgia Kaolin Company, Dry Branch, Ga.

8 (12). Electrophoretic Dewatering of Clay Suspensions

By Sidney Speil: Electrotechnical Laboratory, U. S. Bureau of Mines, Norris, Tenn.

9 (13). The Electron Microscope

By James Hillier, RCA Manufacturing Company, Incorporated, Camden, N. J.

MATERIALS AND EQUIPMENT DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Cloak Room

Wednesday Forenoon, April 2, 1941: 9:30 A.M.–12:00 M.

10. Drying Ceramic Products

By H. B. Matzen: 185 Madison Avenue, New York, N. Y.

Methods are discussed which insure the duplication of correct drying conditions, control the uniformity and quality in the drying operation, raise the percentage of first-class ware, and result in making the firing process more efficient and more uniform. The experience of more than twenty years is used in applying precision control at every stage of the drying operation to obtain a wide variety of ceramic products, such as abrasives, building terra cotta, tile, refractories, telephone conduit, and heavy clay products. The periodic and the continuous driers are described, showing the similarity in the form of the drying cycle for each.

11. Fractionation by Magnetic Means of Minerals Used in the Ceramic Industry

By S. F. Walton and D. M. Ramsey: Exolon Company, Blasdell, N. Y.

The early history of magnetism and the physical laws applying to magnetism are discussed. The development of the electro magnet, types of electro magnets, the relative attractability of various minerals, the magnetic susceptibility of various minerals, and the relation of susceptibility to commercial fractionation or separation are also shown. Magnetic separation may be applied to the beneficiation of ceramic raw materials. Case histories of laboratory work on the magnetic separation of ceramic raw materials and minerals used in the ceramic industry are given, and the commercial applications are explained.

12. Removal of Iron Mineral Impurities from Clays and Sands by Froth Flotation; Quantitative Studies on Adsorption of Certain New Reagents

By Nelson W. Taylor, Donald W. McGlashan, and William A. Scholes: Department of Ceramics, Pennsylvania State College, State College, Pa.

Many factors contribute to the success or failure of mineral separations by the froth-flotation process. One of the most important of these factors is the affinity of a given collecting agent for the mineral surface. Reagents of the xanthate or thiophosphate types have little value except for sulfide minerals. In the search for suitable collecting agents for the removal of iron oxide contaminations from clays and sands, the affinity of certain reagents for quartz, clay, hematite, and limonitic minerals has been tested by adsorption measurements. Adsorption curves are presented, and the important influence of the hydrogen ion of the solution is shown. Flotation tests are described which demonstrate the reliability of the adsorption technique in its relation to the practical flotation problem. Adsorption studies test the suitability of reagents, show the optimum conditions for their use, and aid in understanding the underlying mechanism of the flotation process.

13. Power Consumed in Pugging Clays

By J. F. McMahon: New York State Ceramic Experiment Station, Alfred, N. Y.

Studies on the influence of the temperature of pugging mixtures, soda ash, water content, and wetting agents on power necessary to pug clays are presented.

14. Discussion on Deairing Fine Clay Bodies in Plastic Form

By E. A. Hawk: Hawk Laboratories, Canton, Ohio

Some new methods of deairing fine ceramic materials are described, and an account is given of experiments in processing and the results obtained.

MATERIALS AND EQUIPMENT DIVISION PROGRAM (concluded)

Lord Baltimore Hotel: Cloak Room

Wednesday Afternoon, April 2, 1941: 2:00 P.M.–5:00 P.M.

15. Care of Protective Equipment and Dust Control

By J. B. Littlefield and C. M. Mehaffey: Mines Safety Appliance Company, Braddock Avenue, Pittsburgh, Pa.

16. Industrial Health Service for the Small Plant in the Ceramic Industry

By Huntington Williams, W. H. Schulze, and J. M. McDonald: Baltimore City Health Department, Baltimore, Md.

The potential hazards to be expected in the operation of a plant in the ceramic industry are described, and provision for medical service is discussed. The availability of the industrial hygiene service in the state or local health department is explained, and the cost of the suggested program is also considered.

17. Testing Performance of Mixing Equipment

By Wayne E. Brownell: New York State College of Ceramics, Alfred, N. Y.

Standard tests for measuring the degree of mixing obtained by dry mixing have been developed, and the influence of different mixers and the time of mixing will be discussed.

18. Multiple Tunnel Kilns

By M. S. Nelson and Hewitt Wilson: Electrotechnical Laboratory, U. S. Bureau of Mines, Norris, Tenn.

The multiple tunnel equivalent of a single tunnel kiln, having the same total loading cross section and the same unit output, is discussed. Several advantages are indicated such as (1) faster firing cycle, (2) uniformity of heat distribution, (3) higher efficiency, (4) greater flexibility and compactness, (5) lower construction cost, and (6) lower energy requirements. This type of kiln is especially adaptable to electric firing. Calculations for the multiple equivalent of any single tunnel kiln and a table of equivalents of actual kilns are presented.

19. Determination of Consistency of Clay-Water Mixtures with Brabender Plastograph

By T. N. McVay, A. W. Tencza, and E. C. Gill: University of Alabama, University, Ala.

The consistency curves for different types of clays have been determined with a Brabender plastograph.

REFRACTORIES DIVISION PROGRAM

Chairman: J. B. Austin, Research Laboratory, United States Steel Corporation, Kearny, N. J.
Secretary: R. S. Bradley, A. P. Green Fire Brick Company, Mexico, Mo.

Program Committee
C. L. Thompson, Chairman, Harbison-Walker Refractories Company, Pittsburgh, Pa.
W. R. McLain, Carnegie-Illinois Steel Corporation, Chicago, Ill.
G. S. Diamond, Electro Refractories & Alloys Corporation, Lackawanna, N. Y.
W. R. Kerr, Armstrong Cork Company, Beaver Falls, Pa.

Lord Baltimore Hotel: Private Dining Rooms G, H, I, J

Tuesday Forenoon, April 1, 1941: 9:30 A.M.–12.00 M.

Symposium on Phase Equilibria

9:30–9:45 A.M.

1. Introduction

ROBERT B. SOSMAN, Leader: United States Steel Corporation, Kearny, N. J.

9:45–10:15 A.M.

2. Transformations in One-Component Systems

BY DONALD H. ANDREWS: The Johns Hopkins University, Baltimore, Md.

About ten years ago, in some widely different fields of research, there appeared several new concepts of phase transformations in one-component systems. In 1930, Pauling pointed out that certain heats of transition between solid phases might be due to the setting in of free rotation of the molecules in the crystal at temperatures considerably below the melting point. In order to interpret the transition between the two liquid phases in helium, Ehrenfest suggested the possibility of "second-order" changes in which the heat of transition and the volume change are zero and the transformation is marked only by irregularities in the differential properties such as heat capacity. Rutgers showed that superconductivity may also be related to this class of transformations. Since these ideas were advanced, there has been a great deal of discussion about the proper thermodynamic and statistical treatment, notably by Frenkel, Rutgers, Von Laue, Eucken, Epstein, Mayer and Streeter, and many others. It is clear that there are a large number of phase changes scattered over a wide area which cannot be accounted for in the older and simpler framework of phase concepts. Eucken lists fifty-one different systems in this category. It is becoming increasingly evident, therefore, that the geometric *matter-space*-pattern of the crystal lattice is intimately linked with the *energy*-pattern. The tools for investigating the *matter-space*-pattern, such as the X-ray and electron-diffraction apparatus, must go hand in hand with the *energy*-pattern tools, such as the calorimeter and spectrograph. Only in the combination of the two may a reasonably complete understanding even of the simplest systems be found.

10:15–10:45 A.M.

3. Solid Solution in Three-Component Systems

BY GEORGE W. MOREY: Geophysical Laboratory, Washington, D. C.

The significance of solid solution in phase-equilibrium relationships is discussed in general terms, and a detailed consideration of solid solution in certain binary systems is given. After this elementary introduction, some of the solid solutions in the ternary system $CaO–FeO–SiO_2$ are discussed with special reference to the isothermal planes.

10:45–11:15 A.M.

4. Methods of Studying the Quaternary System $CaO–FeO–Al_2O_3–SiO_2$

BY J. F. SCHAIRER: Geophysical Laboratory, Washington, D. C.

A study of this four-component system is in progress, and data are complete for five planes through the regular tetrahedron used to present the phase relations. Melilites, pyroxenes, and olivines are solid solutions having extensive volumes of stability in the quaternary system. The spinel, $FeO \cdot Al_2O_3$ (hercynite), occupies a conspicuous part of the volume of the tetrahedron.

11:15–11:45 A.M.

5. Phase-Rule Data in Manufacture and Application of Refractories

BY RAYMOND E. BIRCH: Harbison-Walker Refractories Company, Pittsburgh, Pa.

With certain types of refractories, it has been possible to apply phase-rule data to the blending and manufacturing processes. The fields in which these data are useful include silica, magnesite, chrome, dolomite, forsterite, and, to a limited extent, alumina-silica refractories. Phase-rule data are frequently inadequate, and in other cases they have no practical value except when used in conjunction with empirical and seemingly unscientific generalizations. Refractories usually contain five or more oxides which are present in amounts that cannot be ignored. The fact that any application of three-component phase-rule data is possible is due to independent research conclusions which have shown that in some systems there is almost no solubility of certain components in the liquid phase or that one or more components are present almost entirely in solid solution. In predicting which of several types of refractories is likely to succeed best in a given service, usually the available information is insufficient to allow a strict application of phase-rule data. Slagging action to a large degree is dependent on slag viscosity, and reliable viscosity data are generally not available.

REFRACTORIES DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Private Dining Rooms G, H, I, J

Tuesday Afternoon, April 1, 1941: 2:00 P.M.–5:00 P.M.

2:00–2:30 P.M.

6. A Gas-Fired Downdraft Pyrometric Cone Equivalent Furnace

By S. M. Phelps: Refractories Fellowship, Mellon Institute, Pittsburgh, Pa.

A new design for a gas-air fired pyrometric cone equivalent furnace is described, in which higher temperatures and better behavior of the cones during bending are obtained. The flame from a number of burners impinges on incandescent refractory grains and is directed upward and over the cone plaque and then down a central flue. A gas-air proportional mixing device is employed to maintain gas atmosphere and to aid in regulating the temperature.

2:30–3:00 P.M.

7. Description and Discussion of Results of Hot Modulus of Rupture and Hot Crushing Strength Tests

By E. B. Hunt and R. S. Bradley: A. P. Green Fire Brick Company, Mexico, Mo.

The equipment and test procedure used to make modulus of rupture and crushing tests on refractory specimens while heated is described and illustrated. The results of the tests at various temperatures are given for several types of fire-clay refractories and insulating firebrick.

3:00–3:30 P.M.

8. Slag Test Furnace

By R. H. H. Pierce, Jr.: United States Steel Corporation, Kearny, N. J.

A comparatively rapid semiquantitative test for studying the action of an iron oxide-silica slag on refractory brick has been developed and is described.

3:30–4:00 P.M.

9. Design and Operation of Electric Furnaces for Testing Refractories

By M. S. Nelson and Robert R. Ralston: Electrotechnical Laboratory, U. S. Bureau of Mines, Norris, Tenn.

The construction and operation of high-temperature electric pyrometric cone equivalent and load-test furnaces are described. Temperatures to 1900°C. may be obtained with a spiral graphite heating element, which has reasonable voltage and current characteristics. Neither vacuum nor special atmosphere is used inside the furnaces. Data are given on the life and operation of the furnace.

4:00–4:30 P.M.

10. RCA Electron Microscope

By James Hillier: RCA Manufacturing Company, Incorporated, Camden, N. J.

Mr. Hillier will present this paper in Private Dining Rooms D, E, F before the members of the Refractories, Materials and Equipment, and White Wares Divisions.

The useful magnification of microscopes using visible or ultraviolet light is limited to about 3000 diameters owing to the relatively long wave length of the observing medium. High-velocity electrons, which have an extremely short effective wave length, can be used with the aid of electron optics in an electron microscope to obtain magnifications that are about 100 times greater than those obtained with a light microscope.

The electron microscope embodies principles similar to those employed in an optical microscope, with magnetic electron lenses taking the place of glass lenses. An electron microscope capable of high resolution and suitable for general laboratory use has been built in the RCA laboratories. This instrument is rugged, simple to operate, and completely self-contained. Specially designed power supplies provide the extremely constant voltage and current supplies required for its operation. This microscope, which is capable of resolving detail finer than 50 a.u., finds extensive applications in almost every field of science.

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REFRACTORIES DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Private Dining Rooms G, H, I,

Wednesday Forenoon, April 2, 1941: 9:30 A.M.–12:00 M.

9:30–10:00 A.M.

11. Secondary Expansion of High-Alumina Refractories

By James L. Hall: American Brake Shoe & Foundry Company, Mahwah, N. J.

Several mixtures of raw and calcined diaspore and bauxite with raw and calcined fire clays were prepared and fired at 2700°F. Specimens were refired at higher temperatures, and the linear changes were determined. Bodies composed of high-alumina grog and fire clay expand in the refire, whereas specimens of fire-clay grog bonded with ground raw diaspore exhibit shrinkage.

The cause of the secondary expansion and shrinkage of these bodies is discussed.

10:00–10:30 A.M.

12. Characteristics of Secondary Expansion of Some Fire-Clay Refractories

By S. M. Phelps and R. W. Limes: Refractories Fellowship, Mellon Institute, Pittsburgh, Pa.

Comparatively little information has appeared in the literature concerning secondary expansion and it is occasionally the subject of discussion. Useful data obtained from high-heat and superduty fire-clay brick that exhibited this characteristic are therefore presented. Comments are offered as to the nature and cause of the behavior of clays and brick which display secondary expansion. The effects are given of a range of temperatures of reheating, the pressure which must be applied to prevent the occurrence of secondary expansion, and the deformation curves of samples in the hot-load test under the standard as well as a light load. Typical evaluational properties of the brick used in the study are included.

10:30–11:00 A.M.

13. Specific Heat of Chrome and Magnesia Refractories

By Gilbert E. Seil, Frank G. Heck, and H. A. Heiligman: E. J. Lavino & Company, Norristown, Pa.

The previous work in the field is surveyed, and a complete description is given of the two types of chrome refractory and the type of magnesite refractory used in the experimental work, including photomicrographs of the materials. The specific-heat determinations were made in a calorimeter, using carbon tetrachloride as the liquid in which the samples were immersed, and the calorimeter and the auxiliary equipment are described. The procedure used for the determination of the heat capacity of the calorimeter system and of the specific heats of the test samples is given in detail, and the results are summarized and tabulated. The article contains an extensive bibliography on the subject.

11:00–11:30 A.M.

14. Electric Furnace Study of the MgO–SiO_2 System

By Robert R. Ralston and George T. Faust: Electrotechnical Laboratory, U. S. Bureau of Mines, Norris, Tenn.

Two series of magnesia-silica mixtures were fused in a small electric arc-resistance furnace. Flint and precipitated magnesia were used to provide melt compositions of high purity. Olivine, quartz, and dead-burned magnesite were used in the second series to simulate commercial melting operations. No effort was made in either series to reach theoretical equilibrium conditions. The products were analyzed chemically and petrographically.

Petrographic studies were made on a large number of thin sections of products occurring in the system. Whenever it was practicable, Rosiwal analyses were made with the Hunt-Wentworth recording micrometer. Chemical and spectrographic analyses were also made, and the results of the various studies have been correlated.

11:30 A.M.–12:00 M.

15. Electrically Fused Forsterite Refractories

By Robert R. Ralston, M. S. Nelson, and Hewitt Wilson: Electrotechnical Laboratory, U. S. Bureau of Mines, Norris, Tenn.

Forsterite, produced by arc-furnacing olivine, was formed into brick shapes by dry pressing granular materials as well as by electrocasting. The forsterite brick have been tested for refractory properties in order to make a comparison with commercial refractory brick.

Refractories Division Luncheon and Business Meeting

Lord Baltimore Hotel: Coffee Shop

Wednesday Noon, April 2, 1941: 12:00 M.–2:00 P.M.

REFRACTORIES DIVISION PROGRAM (concluded)

Lord Baltimore Hotel: Private Dining Rooms G, H, I, J

Wednesday Afternoon, April 2, 1941: 2:00 P.M.–5:00 P.M.

2:00–2:30 P.M.

16. Catalytic Mullitization of Kaolinite by Some Oxides

By C. W. Parmelee and A. R. Rodriguez: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

The effect of the addition of various oxides on the mullitization of kaolinite was studied by chemical, microscopic, and X-ray methods. A comparative study of the chemical and the X-ray methods of mullite determination shows that the chemical method (use of hydrofluoric acid) can yield only relative values. The use of X-ray appears to give absolute results.

The oxides of zinc, lithium, magnesium, iron, manganese, and molybdenum were found to be good mullite builders. Sodium, potassium, titanium, and stannic oxides are poor accelerators and boric oxide and calcium give fair results.

2:30–3:00 P.M.

17. Testing Refractories Against Molten "Metaphos" at 1300°C.

By Gordon R. Pole and A. W. Beinlich: Tennessee Valley Authority, Wilson Dam, Ala.

During the experimental development by the Tennessee Valley Authority of a process for making crude calcium metaphosphate (Metaphos) containing about 65% of P_2O_5 and 26% of CaO, the selection of refractories resistant to the corrosive action of the molten product became a major problem. As a result, it was necessary to develop a laboratory method of testing different commercial refractories under conditions that would simulate as nearly as possible the service conditions to be expected in a large-scale Metaphos furnace.

A description of the corrosion test method that was adopted and the results of tests made on twenty-six commercial refractories are given. An oil-fired, pot-type furnace, with an inside diameter of 24 in. and 12 in. deep, was used. Each test consisted of suspending four $13^1/_2$- by $4^1/_2$- by $2^1/_2$-in. standard refractory shapes from the furnace crown so that they dipped into a bath of molten Metaphos to a depth of 2 to 3 in. The bath was maintained at 1300°C. for 66 hours. A linear flow past the brick of approximately 3 to 4 ft. per min. was imparted to the surface of the molten Metaphos by the blast from the oil burners. Fresh Metaphos was added at hourly intervals in order to maintain a constant bath level and as a means of compensating for the change in composition caused by the solution of the test brick. The degree of corrosion was measured by determining the volume and weight changes of each refractory. The results obtained approximated those found in a large-scale plant furnace. Petrographic studies were made on thin sections taken from a number of test brick.

The three most resistant refractories found by the method of testing were zircon, high-silica vacuum-cast refractories, and dense stiff-mud brick.

3:00–3:30 P.M.

18. Lumnite Cement as Bond in High-Alumina Refractories

By Paul G. Herold and J. L. Hoffman: Missouri School of Mines, Rolla, Mo.

A series of mixtures of various grain sizes of corundum and Lumnite were formed by tamping the slurry in brass molds. Pyrometric cone equivalent determinations of all the mixes showed that free silica is extremely detrimental to refractoriness. The best refractory seemed to be one composed of a large proportion of fine-grained corundum bonded with from 5 to $12^1/_2$% of Lumnite cement.

3:30–4:00 P.M.

19. Properties of Air-Setting Refractory Mortars of the Dry Type

By R. A. Heindl and W. L. Pendergast: National Bureau of Standards, Washington, D. C.

The results of tests on eighteen proprietary brands of air-setting mortars marketed in the dry condition are given. The tests include fineness, alkali content, pyrometric cone equivalent, workability, transverse strength, and appearance after heating the mortar alone at several temperatures and also when it was used as a bond with firebrick.

4:00–4:30 P.M.

20. An Improved Gas-Expansion Porosimeter

By Joseph C. Richmond and John B. Peterson: National Bureau of Standards, Washington, D. C.

A gas-expansion porosimeter of improved design has been developed at the National Bureau of Standards for measuring the porosity of full-sized brick, including refractory brick. The chief feature of the design is the use of a closed-cistern altitude-type mercurial barometer to replace the simple manometer previously used in other designs. The barometer has a range of 70 to 910 mm. of mercury and is equipped with a vernier reading to 0.1 mm. over the entire scale.

21. Structures, Compositions, and Base-Exchange Capacities of Clay Minerals

By Sterling B. Hendricks: Fertilizer Research Division, U. S. Bureau of Plant Industry, Beltsville, Md.

The underlying reasons for base exchange in clays will be illustrated by models. The causes for variations in compositions of clay minerals with particular reference to iron, magnesium, sodium, potassium, and calcium are discussed, and methods now in use for the mineralogical examination of clays are described.

STRUCTURAL CLAY PRODUCTS DIVISION PROGRAM

Chairman: H. Z. Schofield, Engineering Experiment Station, Ohio State University, Columbus, Ohio
Secretary: L. R. Whitaker, Richland Shale Products Company, Richtex, S. C.

Program Committee
H. D. Foster, Chairman; Engineering Experiment Station, Ohio State University, Columbus, Ohio
F. E. Lobaugh, Atlas Lumnite Cement Corporation, Chrysler Building, New York, N. Y.
J. E. Rankin, Pine Hall, N. C.

Lord Baltimore Hotel: Private Dining Rooms A, B, C

Tuesday Forenoon, April 1, 1941: 9:30 A.M.–12:00 M.

1. Dies and Augers in Relation to Deaired Materials

By J. H. Isenhour: Isenhour Brick & Tile Company, Incorporated, Salisbury, N. C.

The writer discusses the types of dies and augers best suited for most deaired clays. The relation between augers and dies and the causes of lamination and warped brick are pointed out.

2. Dies for Laboratory Auger Machines

By H. E. Petty and J. L. Carruthers: Department of Ceramic Engineering, Ohio State University, Columbus, Ohio

The effect of length and taper on dies for laboratory auger machines is studied on a sandy, a sticky, and a greasy clay. Difficulties in extruding clays, power consumption in the die, and rate of clay flow from the die are found to be directly affected by die length and die taper. Information is also gained as to the nature of clay flow through dies.

3. Practical Application of Heat and Humidity Automatic Controls to Driers

By R. R. Robinson: Robinson Ventilating Company, Zelienople, Pa.

The fundamental principles of drying ceramic ware are discussed and practical methods of applying automatic controls to the heat and moisture supply in existing driers are described. These applications are made (1) to the continuous tunnel drier in which the ware passes progressively through the drier from one set of air and moisture conditions to another and (2) to the batch drier in which the ware remains stationary and the air and moisture conditions are changed as the drying progresses.

4. Tunnel Drier Refinements

By T. W. Garve: 314 King Avenue, Columbus, Ohio

The innovations recommended refer to the hot-air intake flue, the underground tunnel inlets, the cross section of the drying tunnels, as well as the tunnel doors.

5. Stoker Installation and Operation

By L. R. Whitaker: Richland Shale Products Company, Richtex, S. C.

A study is presented of the use of stokers in firing brick and tile from the standpoint of liquidating the installation costs and the savings effected in fuel cost and improvement of quality. The adaptation of the operation of stokers to kiln schedule, kiln atmosphere, and uniform ware in kilns is also outlined.

Structural Clay Products Division Luncheon
Lord Baltimore Hotel:
Private Dining Rooms A, B, C
Tuesday Noon, April 1, 1941: 12:00 M.–1:30 P.M.

STRUCTURAL CLAY PRODUCTS DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Private Dining Rooms A, B, C

Tuesday Afternoon, April 1, 1941: 2:00 P.M.–5:00 P.M.

6. Annual Business Meeting of Division

7. Advantages of Insulating Firebrick for Red Brick Kiln Construction

By J. D. McCullough: Babcock & Wilcox Company, New York, N. Y.

The use of insulating firebrick directly exposed to the furnace gases in the construction of kilns for firing common brick and tile is discussed. Owing to the small amount of heat stored in and conducted through the firebrick, the length of the firing cycle may be reduced and substantial fuel savings may be effected.

8. Relation Between Air and Water Permeabilities of Building Brick

By R. T. Stull and P. V. Johnson: National Bureau of Standards, Washington, D. C.

According to Poiseuille's equation for the flow of fluids through capillaries, the ratio of the air-permeability coefficient, f_1, to that of water, f_2, should be equal to 55.5, which is the approximate value of the ratio of the viscosity of water to that of air. The value of $f_1/55.5 f_2$ should therefore approximately equal unity. Air- and water-permea-

bility coefficients determined on forty-one brick indicated that the value of $f_1/55.5f_2$ decreased from 9.4 to 3.1 as the mean effective capillary radius of the brick increased from 1.4 to 4.1 microns.

9. Effect of Differences in Raw Materials and Methods of Forming on Certain Properties of Building Brick

By J. W. McBurney: National Bureau of Standards, Washington, D. C.

Compressive and transverse strength, absorption by cold immersion and by 5-hr. boiling, saturation coefficient and resistance to freezing and thawing (50 cycles) have been determined on 3200 brick made from surface clay, fire clay, or shale and formed by the soft-mud, stiff-mud (end-cut and side-cut), or dry-press processes. The effect on these properties is discussed as well as their relation to differences in the raw materials and methods of forming.

STRUCTURAL CLAY PRODUCTS DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Private Dining Rooms A, B, C

Wednesday Forenoon, April 2, 1941: 9:30 A.M.–12:00 M.

10. Testing Drying Behavior of Clays

By H. G. Schurecht and J. F. McMahon: New York State Ceramic Experiment Station, Alfred, N. Y.

A comparatively simple test was developed for determining the drying behavior of clays. Methods for the improvement of the drying properties of clays were also investigated.

11. Why Fire Ceramic Ware So Long?

By H. R. Straight: Straight Engineering Company Adel, Iowa

Results of experiments of four years on 100,000 tons of heavy clayware are presented. Through the introduction of alkalized hydrated silicates in saponified combinations into the water of plasticity, a fairly uniform distribution is attained in thin films. Conditions are set up which are favorable to the formation of the bonding glass, thereby accelerating body maturity at lower temperatures.

12. Base-Exchange Properties of Clay

By Emil Truog: Department of Soils, University of Wisconsin, Madison, Wis.

Several typical clays used in the manufacture of structural clay products are discussed. The base-exchange capacity of several clays are given as well as an explanation of the theory of base exchange in clays.

13. Further Investigation in Improvement of Clays Through Hydrogen-Ion Control

By G. J. Barker: Department of Mining and Metallurgical Engineering, University of Wisconsin, Madison, Wis.

Recent studies in treating clay by pH control for plant practice are discussed. Hydrogen-ion curves with peculiar characteristics are shown. An explanation of the variation in types of curves is developed, and a summary of results obtained in plant use is made.

14. Effects of Steam and Hot Water Together with Soda Ash and Wetting Agents on Properties of Some Clays

By H. G. Schurecht, J. F. McMahon, and C. Major Lampman: New York State Ceramic Experiment Station, Alfred, N. Y.

The influence of hot water or steam on the properties of clays was studied with and without the addition of soda ash and wetting agents. The strength of clays was increased in some cases as much as 125% by the use of these treatments.

STRUCTURAL CLAY PRODUCTS DIVISION PROGRAM (concluded)

Lord Baltimore Hotel: Private Dining Rooms A, B, C

Wednesday Afternoon, April 2, 1941: 2:00 P.M.–5:00 P.M.

15. Modern Brick-Pavement Construction Methods and Materials

By H. Z. Schofield: National Paving Brick Association Research Bureau, Engineering Experiment Station, Ohio State University, Columbus, Ohio

The monolithic and the two-course brick pavement are discussed. The benefits from the use of proper construction methods and properly selected associate materials are given.

16. Résumé of Technical Studies of Salt Glazes

By Harry D. Foster: Engineering Experiment Station, Ohio State University, Columbus, Ohio

A résumé is given of the technique of the production of salt glazes, calling attention to some of the deficiencies which are found in salt glazes but which are not generally recognized as such.

17. Prefabricated Structural Clay Tile Floor System

By E. F. Wanner: National Fireproofing Corporation, Pittsburgh, Pa.

A description is given of the development, test methods, and results of the application of prestressed ceramic building members to modern building construction. Comparisons are made showing the effect of grouted and ungrouted reinforced bars subjected to the same degree of prestressng. The difference is also pointed out between thin mortar joints and ground end units without mortar to develop the maximum compressive resistance inherent in structural clay tile bodies.

18. Clay Products in the Defense Construction Program

By H. C. Plummer and C. T. Bridgman: Structural Clay Products Institute, 1427 Eye Street, N.W., Washington, D. C.

A summary is given of the requirements for defense structures as developed by the various Federal agencies as well as an outline of the use that has been made of clay products in such construction. Suggestions are made for the adaptation and specifications of clay products to make possible increased use of brick and tile in defense construction.

19. Immediate Need for Research in the Structural Clay Products Industry

By Douglas F. Stevens: , State Geological Survey, Urbana, Ill.

The writer considers present world conditions and their probable effect on the structural clay industry. The topics discussed are (1) the competitive materials for new products and new methods to meet them and (2) the need for extensive research dealing with materials, equipment, processes, and products to enable the structural clay industry to meet rapidly changing conditions.

STRUCTURAL CLAY PRODUCTS DIVISION
PLANT TRIP
Thursday Afternoon, April 3, 1941
Washington Brick Co. (Circle System), Muirkirk, Md.

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WHITE WARES DIVISION PROGRAM

Chairman: Harry Thiemecke, Homer Laughlin China Company, Newell, W. Va.
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Program Committee
F. C. Henderson, Chairman, Hall China Company, East Liverpool, Ohio
Howard Failmezger, 96 Colonial Village Road, Rochester, N. Y.
C. G. Harman, Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

Lord Baltimore Hotel: Private Dining Rooms D, E, F

Tuesday Forenoon, April 1, 1941: 9:30 A.M.–12:00 M.

1. Selas Radiant Gas Burner in Allied Circular Tunnel Kiln for Direct Bisque Firing at Cone 7

By Leslie Brown: Lenox, Incorporated, Trenton, N. J.

2. Warpage of Plates

By Hewitt Wilson: Electrotechnical Laboratory, U. S. Bureau of Mines, Norris, Tenn.

This discussion covers the general and specific causes of warpage, and the measurement of rim and height warpage, shrinkage, absorption, rim angles, and tests of different methods of placing and supporting plates in the bung.

3. Low-Temperature Vitreous Bodies

By A. E. Baggs: Department of Fine Arts; and C. J. Koenig: Engineering Experiment Station, Ohio State University, Columbus, Ohio.

The properties of a series of low-temperature bodies comprised of clays and nepheline syenite are described. These bodies have a higher alumina content than typical pottery bodies because of the high alumina content of nepheline syenite and the absence of free flint. The high alumina content of these bodies favors long vitrification ranges.

4. Study of Soluble Sulfates in Whiteware Bodies

By W. P. Cortelyou and Hewitt Wilson: Electrotechnical Laboratory, U. S. Bureau of Mines, Norris, Tenn.

Samples of slips, filter-press cakes, and filtrates from a number of body mixtures were analyzed for soluble sulfates. The efficiency of the removal of soluble sulfate by simple washing and pressing is discussed. Data are presented to show the effect of aging on the concentration of soluble sulfates in slips and filter cakes.

5. Some Properties of Glasses in the System K_2O–Al_2O_3–SiO_2

By G. R. Shelton: National Bureau of Standards, Washington, D. C.

The annealing range, expansion, and softening temperature were determined on glasses in the composition range of the phase-equilibrium diagram reported by Schairer.

6. Fundamental Study of Clay: II, Mechanism of Deflocculation in Clay-Water Systems

By A. L. Johnson and F. H. Norton: Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

The effect is shown of bases and of basic, neutral, and acid salts and acids on the viscosity of clay slips, which have been cleaned as described in Part I (*Jour. Amer. Ceram. Soc.*, **24** [1] 64–69 (1941)). From these data, a fundamental theory of deflocculation is built up, based on the fact that deflocculation requires the presence of OH anions and monovalent cations. The influence on the viscosity of small traces of soluble salts or adsorbed ions, as present in commercial clays, is discussed, and it is shown why sodium silicate or carbonate works more satisfactorily than sodium hydroxide in the deflocculation of commercial casting slips.

7. Testing Ball Clays

By Arthur S. Watts: Department of Ceramic Engineering, Ohio State University, Columbus, Ohio

A survey of types of ball clays and their properties as related to industrial uses is presented. The development of test methods for disclosing the essential information is also discussed.

8. Study of Ball Clays

By T. A. Klinefelter and M. D. Burdick: National Bureau of Standards, Washington, D. C.

The exchange of bases and resulting effects on the properties of several typical ball clays are discussed.

White Wares Division Luncheon and Business Meeting
Lord Baltimore Hotel: Private Dining Rooms D and E
Tuesday Noon, April 1, 1941: 12:30 P.M.–2:00 P.M.

WHITE WARES DIVISION PROGRAM (continued)

SYMPOSIUM ON PARTICLE SIZE

Joint Meeting with Materials and Equipment Division: S. S. Cole, Presiding Chairman

Note: Members of the Refractories Division will join this session for paper No. 13 by James Hillier.

Lord Baltimore Hotel: Private Dining Rooms D, E, F

Tuesday Afternoon, April 1, 1941: 2:00 P.M.–5:00 P.M.

9. New Method of Purifying Water for the Ceramic Industry

By W. S. Morrison: Illinois Water Treatment Company, Rockford, Ill.

A discussion is presented of (1) the flow reactions in the antionic and cationic exchange units, (2) the history of the development of these exchange zeolites and types of water on which the unit will work out effluent reactions on slides, and (3) the chemical content of the zeolites. Curves showing the performance of the various units in the enamel plant and the allied ceramic industry will also be presented.

10. Particle-Size Distribution of Glazes

By J. H. Koenig and F. C. Henderson: Hall China Company, East Liverpool, Ohio

Particle-size distribution was determined on experimental and commercial stains and glazes, and the results correlated with glaze-working properties and certain physical properties of the fired film. Measurements were made by microscopic means, and in some cases data were taken using the Andreasen pipette.

11. Some Practical Aspects of Particle-Size Control

By S. C. Lyons: Georgia Kaolin Company, Dry Branch, Ga.

A description of the nature of fractionation is offered together with photomicrographic and analytical data concerning some clay fractions. Recent technical and industrial applications of fractionated products are mentioned, and a review of the basic principles of pneumatic and hydraulic classification is sketched together. The advantages of hydraulic separations, made under high settling forces (under centrifugal forces) are outlined and brief descriptions of the processes and machines, for example, the Bird continuous centrifuge, are presented.

12. Electrophoretic Dewatering of Clay Suspensions

By Sidney Speil: Electrotechnical Laboratory, U. S. Bureau of Mines, Norris, Tenn.

The electrophoretic behavior of an American ball clay has been investigated, using a simple stationary electrode apparatus. The effects of amount and type of electrolyte, hydrogen ion, type of electrode, potential gradient, electrode separation, time of deposition, solids concentration, and temperature of the suspension were studied. Data are presented to show the effect of these variables on energy efficiency, rate of deposition, and moisture content of the deposit.

13. The Electron Microscope (presented by courtesy of the Refractories Division)

By James Hillier: RCA Manufacturing Company, Incorporated, Camden, N. J.

The useful magnification of microscopes using visible or ultraviolet light is limited to about 3000 diameters owing to the relatively long wave length of the observing medium. High-velocity electrons, which have an extremely short effective wave length, can be used with the aid of electron optics in an electron microscope to obtain magnifications that are about 100 times greater than those obtained with a light microscope.

The electron microscope embodies principles similar to those employed in an optical microscope, with magnetic electron lenses taking the place of glass lenses. An electron microscope, capable of high resolution and suitable for general laboratory use, has been built in the RCA laboratories. This instrument is rugged, simple to operate, and completely self-contained. Specially designed power supplies provide the extremely constant voltage and current supplies required for its operation. This microscope, which is capable of resolving detail finer than 50 a.u., finds extensive applications in almost every field of science.

WHITE WARES DIVISION PROGRAM (continued)

Lord Baltimore Hotel: Private Dining Rooms D, E, F

Wednesday Forenoon, April 2, 1941: 9:30 A.M.–12:00 M.

SESSION ON BODY PROPERTIES

14. Influence of Zircon, Talc, and Feldspar Mixtures on Some Properties of Whiteware Bodies

By J. F. McMahon and Samuel A. Fossaceca: New York State Ceramic Experiment Station, Alfred, N. Y.

Additions of zircon to talc bodies increased their temperature range between crazing and shivering, whereas zircon additions to feldspar bodies reduced the moisture expansion of the bodies.

15. Stress-Strain Characteristics of Plastic Clay Masses and Their Relationship to Plasticity

By Ralston Russell, Jr., and C. F. Hanks, Jr.: Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The mechanical properties of plastic clay masses in terms of the fundamental concepts, stress and strain, and an interpretation involving the general terms, plasticity and workability, were investigated. Compressive forces, applied by means of newly designed apparatus, were used throughout. A description is given of the apparatus and methods as well as the results for thirteen different types of bodies and five individual clays. The clays were also mixed and tested with nonplastics. In addition to composition, the factors investigated were effect of water content, of aging, of rate of stress application, and of organic additions. The results permit a better understanding of the fundamentals of plasticity and workability and indicate promise for the development of a practical but simple method of evaluating the combination of properties known as workability.

16. Effects of Deairing, Forming Methods, and Rates of Heating on Properties of Whiteware Bodies

By R. F. Geller and A. S. Creamer: National Bureau of Standards, Washington, D. C.

Bodies of twelve different compositions were formed by pressing, by hand-wedging and extrusion, and by deairing and extrusion. They were heated on six different schedules, and determinations were made of such properties as shrinkage, absorption, strength, and linear thermal expansion.

17. Influence of Firing and Cooling Rates on Properties of a Vitreous China Body and an Electrical Porcelain Body

By A. S. Watts, A. E. Currier, and P. P. Irwin: Department of Ceramic Engineering, Ohio State University, Columbus, Ohio

A typical body of each type is prepared and extruded into bars under uniform conditions. Representative specimens of each body are fired to 1280°C. at three different rates and cooled at three different rates in a Globar-type furnace, which is equipped with every control and is also carefully standardized. The properties of the product are catalogued and the influence of firing and cooling treatments disclosed.

18. Modulus of Elasticity of Dinnerware Bodies by the Sonic-Vibration Method

By S. V. Forgue and G. A. Loomis: Engineering Experiment Station, Ohio State University, Columbus, Ohio

The results of modulus of elasticity determinations from sonic-vibration measurements on specimens of several different vitreous and semivitreous dinnerware bodies are compared with modulus determinations on the same specimens by the improved stress-strain technique.

19. Use of a Photronic Cell to Measure Translucency of Whiteware

By Frank C. Arrance: New York State Ceramic Experiment Station, Alfred, N. Y.

The translucency of whiteware bodies, 3 to 5 mm. thick, was measured with a sensitive photronic cell connected to a d'Arsonal galvanometer. A 3- to 6-candlepower concentrated filament electric lamp operated by a 6-volt storage battery was used. A water cell, placed between the light and the cell, absorbed the radiant heat from the light.

WHITE WARES DIVISION PROGRAM (continued)

SESSION ON GLAZES

Lord Baltimore Hotel: Private Dining Rooms D, E, F

Wednesday Afternoon, April 2, 1941: 2:00 P.M.–5:00 P.M.

20. Effect of Zirconium Silicate Additions on Abrasion Resistance and Various Properties of Several Glazes

By C. H. Commons, Jr.: Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

A test method is described and the results of four series of experiments are given for the empirical evaluation of the effect of Zircopax in improving the resistance to abrasion of glazes. Simultaneous resistance to crazing and the effect on gloss, color, and opacity are noted.

21. Use of Phosphate Opacifying Agents in Sanitary-Ware Glazes

By W. H. Earhart: 42 Orchard Lane, Columbus, Ohio

Attention is directed to the possible use of various phosphates in producing opacity in certain types of sanitary-ware glazes. Glaze compositions and some test results are given.

22. Effect of Glaze Stress on Physical Properties of a Vitreous Body

By W. C. Bell: Engineering Experiment Station, Ohio State University, Columbus, Ohio; and J. H. Koenig: Hall China Company, East Liverpool, Ohio

Data are presented to show the correlation between glaze stress, flexural strength, and thermal-shock resistance of a vitreous body with various glazes.

23. Effect of Glaze Penetration on Resistance of Porous Bodies to Crazing and Shivering

By Everett Thomas: New York State Ceramic Experiment Station, Alfred, N. Y.

The glaze fit on raw and bisque semivitreous ware was investigated with borax and lead glazes. A better glaze fit was obtained when the glaze was applied on the raw body apparently because of the greater penetration of the glaze into the body.

24. Study of Glaze and Body Interface

By C. W. Parmelee and Paul E. Buckles: Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

Lead-containing raw glazes were applied on biscuit tile and fired at cones 02, 2, and 4. The glaze body interface was examined microscopically by preparing thin cross sections. The powdered glassy portion was also investigated.

Because the crystals separating at the interface were frequently too small for satisfactory study, a technique for promoting their growth was used. Anorthite, wollastonite, gehlenite, undissolved quartz, tridymite, and cristobalite were observed.

The effects of altering the bases of the alumina and silica content of the glaze were studied, and the amount and the effect of the solution of the body were examined. It is concluded that the interfacial layer is not necessarily intermediate in expansion conduct.

White Wares Division Business Session

WHITE WARES DIVISION PROGRAM (concluded)

SESSION ON BODY INGREDIENTS

Lord Baltimore Hotel: Private Dining Rooms D, E, F

Thursday Forenoon, April 3, 1941: 9:30 A.M.–12:00 M.

25. Use of Mixtures of Soda Feldspar, Potash Feldspar, and Spodumene as Fluxes in Whiteware Bodies

By H. G. Schurecht, Joseph K. Shapiro, and Zeno Zabawsky: New York State Ceramic Experiment Station, Alfred, N. Y.

The mixtures of soda feldspar, potash feldspar, and spodumene, which produced the lowest maturing vitreous and semivitreous whiteware bodies, were investigated. The maturing temperature or the flux content is reduced considerably by the use of these mixtures.

26. Study of Eutectic Fluxes in Semivitreous and Vitreous Whiteware Bodies

By C. R. Austin and S. J. Brooks: Battelle Memorial Institute, Columbus, Ohio

Frits of oxides of lithium, barium, calcium, and magnesium combined with calcined alumina and pulverized flint were substituted for feldspar in a dry-press whiteware body. Three series of bodies were studied which contained (1) about one half the normal RO content, (2) the normal RO content, and (3) about three times the normal RO content. Firing behavior and mechanical properties of the various bodies in the vitreous and semivitreous range were determined, and the results are reported in this paper.

27. Compositions and Properties of Some High-Titania Ceramics

By Louis Navias: Research Laboratory, General Electric Company, Schenectady, N. Y.

Compositions of high titania ceramic bodies which mature at cone 10 are given. One series contains calcium titanium silicate as an essential flux; the other contains alkali-free titania glasses. Electrical measurements cover the range, 60, 1000, and 1,000,000 cycles for both power factor and dielectric constant. Detailed consideration is given to the type of electrodes used. The properties covering dielectric strength, temperature coefficient of capacity, effect of humidity, and thermal expansion are given for one composition. An X-ray diffraction pattern of this body shows the formation of rutile crystals.

28. Nepheline Syenite in Hotel China Bodies

By C. J. Koenig: Engineering Experiment Station, Ohio State University, Columbus, Ohio

A series of hotel chinaware bodies based on the commercial body composition were prepared. The greater fluxing activity of nepheline syenite as compared to feldspar was compensated for (1) by lowering the firing temperature, (2) by reducing the amount of the principle flux, and (3) by reducing or eliminating the auxiliary flux.

29. Role of Phosphorus in Bone China

By Woldemar Weyl: Pennsylvania State College, State College, Pa.

Based on the behavior of phosphates in silicate melts, a possible picture of the constitution of bone china bodies is presented. The characteristic features are the formation of fluor- and hydroxy-apatite as the chief constituents of the rigid framework and of a glass high in lime having a higher refractive index than the glassy matrix of normal porcelain bodies. On this basis, the translucency, the whiteness, and certain characteristic defects of bone china may be explained.

30. Dehydrated Clay: Low-Temperature Glasslike Bond in Ceramic Products

By G. R. Shelton: National Bureau of Standards, Washington, D. C.

The process of vitrification begins with the formation of amorphous Al_2O_3 and SiO_2 when kaolin is dehydrated at approximately 550°C. Tests made on various mixtures of china clay, feldspar, and flint indicate that reactions occur at the relatively low temperature of 600°C. There is a gradual merging of the glasslike bond into a true glassy bond as the temperature of the mixtures is increased.

31. White Firing Volcanic Ash in Texas as a Body Ingredient

By F. K. Pence: Bureau of Industrial Chemistry, University of Texas, Austin, Texas

CERAMIC HISTORY

CARL GEORGE HILGENBERG

Carl George Hilgenberg, the son of Charles and Johanne Lertz Hilgenberg, was born in the city of Baltimore, Maryland, on October 1, 1873. His father, at that time a prominent Baltimore merchant, retired from an active business life a few years later. Young Carl Hilgenberg attended the Scheibs-Deichman school in Baltimore and later received his higher education in Eisenach, Germany.

In 1889, Charles Hilgenberg, growing weary of his retirement, financed the establishment of the Carr-Lowrey Glass Company and returned to a business life as the President of the Company. Carl Hilgenberg at the age of eighteen began his long association with the Company by entering its employ as office boy. A succession of advances through the various departments of the office prepared him for the executive post of Secretary, to which office he was elected April 13, 1899, shortly after the death of his father. Interested in finding better ways of office and factory procedure, he relied strongly on observation of those processes as a means of evaluating proposed changes. This observation, coupled with a fine interest in people, led to the development of personal friendships with many of the men engaged in the factory operations. For years, his sailing companion was one of the glass blowers, and many afternoons found them fishing out on the bay.

Progressive Management of Company

On April 11, 1901, Carl G. Hilgenberg became President of the Company. Cooperation meetings and meetings of the foremen of the various departments for the purpose of considering questions of factory operation were initiated. A costing system, accurate and yet simple in operation, which gave detailed figures and comparisons, was set up and installed. The basic soundness of this system was attested by its successful operation for more than thirty-five years. Included in the forms was a stock record card which was identical with the modern perpetual inventory form.

Tour of U. S. Glass Plants

In 1905, Carl Hilgenberg and the plant superintendent arranged and made an extended tour of a majority of the glass plants then operating in the eastern section of the country, observing in each the methods of operation and the layout and equipment used in manufacture. Based on these observations, plans were made for a new factory addition to double the production capacity of the firm; this addition was built in 1907. Indicative of the progressive management, the new sixteen-arch furnace was housed in a reinforced concrete building and roofed by what was then the largest reinforced concrete dome in the country in order to provide unobstructed working space. Shortly thereafter the first continuous tank furnace of the firm was installed, using the recuperative principle and supplying glass to hand-shop operations. This first tank was christened "The Hilgendink."

When the Owens machine was brought out, Mr. Hilgenberg tried to obtain concessions for its use but was unable to do so. Realizing, however, that the machine was going to be a definitely permanent factor in bottle-plant operation and not merely a noble experiment, he installed hand-fed machines at the continuous tank to augment the hand-blown production. With an increase in business, another continuous tank had been built, and when the paddle feeder appeared on the manufacturing horizon, this tank was raised and the feeders were installed to work in conjunction with Lynch machines. Immediately after the war in 1918, business was booming, and customers' demands for deliveries were so loud that it became necessary for a time to lease and operate a factory in Swedesboro, New Jersey.

European Plants Compared

In 1925, Mr. Hilgenberg, realizing that the machine processes of bottle manufacture were receiving the attention of American engineers with a consequent lack of development of hand-shop practice, made the first of a series of trips to Europe to observe the hand operations there. These visits to European plants were made pleasant by the courtesy of their managers. He was convinced, moreover, that Americans had something to learn in the art of fine bottle manufacture. This prompted him later on to send members of both the factory and office organization to extend those observations.

One of the features of the European hand-shop practice which particularly impressed him was the machinery that was used to aid and extend the efforts of the glass blower. Arrangements were made to have one of the most interesting of these machines shipped to the factory in Baltimore so that it could be tried. Efforts to use the machine with American workmen, however, were not commercially successful because the difference in the methods of the European and American workman was too great to be bridged by a hand-operated machine and it was not feasible to undertake a long campaign of re-education of the workers. The venture was not a failure, however, as the foundation had been laid for the later successful development of equipment which was built to fit into the American methods and which proved to increase the scope of the glassworkers' efforts.

Establishes Plant-Sized Laboratory

In 1929, Mr. Hilgenberg became interested in the "I.S." machine, which was being developed by the Hartford-Empire Company, and he offered the use of the Carr-Lowrey factory as a plant-sized laboratory and proving ground for the development of the equipment.

Aviation and Inventions

He became Executive Chairman of the Board of Directors of the Carr-Lowrey Glass Company in 1931 and still evinces just as active an interest in the affairs of the Company as formerly.

Mr. Hilgenberg's enthusiasm for aviation is well known; he was a passenger on one of the first return trips on the voyages of the Hindenburg and was also on one of the early trips of the Atlantic Clipper to Europe.

One of the most interesting patents that has been issued to Mr. Hilgenberg covers a bottle which is familiar to everyone who buys ink. This development was based on his idea of improving the conventional ink container so that the pen could be filled without smearing and so that the last ink in the bottle could be used easily The bottle is made with a pocket inside the shoulder which can be filled by tilting, which holds sufficient ink to fill a fountain pen, and which does not allow the ink to get on the barrel. It required several years of development work to perfect the method of manufacture, and the bottles are now seen wherever ink is sold.

His family consists of his wife, Angelica Rogge, whom he married in 1898, and their three children, Carl Rogge, Charles Edward, and Angela Carr Hilgenberg. He is a director of the Union Trust Company of Maryland and of the Maryland Workshop for the Blind.

Carl George Hilgenberg has many friends in the glass industry. He is particularly well known to those with whom he made the European Ceramic Tour in 1928 and to those members of the British Society who visited the United States in 1929. To Carl Hilgenberg is due much credit for making their visit to Baltimore an enjoyable and pleasant one.

HISTORY OF THE CARR-LOWREY GLASS COMPANY

In the Westport section of Baltimore, on the shores of the Middle Branch of the Patapsco River, is situated the plant of one of the oldest of present-day glass bottle manufacturers, which manufactures machine-made flint glass containers and opal jars as well as fine handmade glass bottles.

Samuel J. Carr and William W. Lowrey, the founders of the Company, were glass bottle salesmen. They enlisted the financial aid of Charles Hilgenberg, a retired merchant, and organized the Company in 1889 to engage primarily in the manufacture of bottles for the drug and perfume trade. The Company started operations with one 8-arch pot furnace. A few years later a duplicate furnace was built, which doubled the production capacity. Charles Hilgenberg continued to serve as President until his death at the end of the century, and in 1901 his son, Carl George Hilgenberg, succeeded that position, continuing the able guidance so essential to a new and growing concern.

George F. Lang

Officers of the Company

The expansion of the plant continued, and in 1926, George F. Lang, Vice-President of the National Central Bank of Baltimore, resigned his position with the bank and became the Vice-President of the Carr-Lowrey Glass Company; he was elected President of the Company in 1931 when Carl G. Hilgenberg became Executive Chairman.

Walter R. Leach

Walter R. Leach, Secretary and General Manager, entered the employ of the Company in 1895 as office boy, and at the age of eighteen was sent out on the road as salesman; he became General Manager in 1914, and Secretary in 1917.

Carl R. Hilgenberg

Carl Rogge Hilgenberg is Treasurer and Comptroller.

Plant Developments

The latest step in the growth of the Company occurred in 1938 with the installation of a completely new and modern melting, forming, and annealing unit. Number 6 tank, as it is known, is built on filled ground reclaimed from the river by dumping the ashes of many years from the pot-furnace operation. Housed in a modern, sheet-metal factory building that is well lighted and ventilated, the melting unit is of particular interest to operating men owing to some departures from standard tank design.

This unit is of the 3-port, cross-fired, regenerative type, fired with producer gas which is generated in a 10-foot Wellman producer.

Because of its convenient location, coal is lightered in on barges and transferred by a clamshell bucket to a small feeder hopper which regulates the flow of coal to a rubber belt conveyer. The conveyer in turn delivers the coal to an overhead storage hopper of some 30 tons capacity, located directly over the gas producer. Efficiency and ease of operation as well as the comfort of the operator are aided by the use of a feed mechanism of the double-bell type which prevents the escape of any appreciable quantity of gas to the producer-house atmosphere. Short insulated steel piping guards against the deposition of excessive quantities of tar and soot and insures the delivery of gas of high sensible heat content to the tank proper.

The ports of the tank are of graduated width and so designed as to prevent excessive temperatures caused by preignition within the port. The tank has a glass depth of 32 inches in the melting end and 18 inches in the working end or nose. The throat design is abnormally wide and shallow and is divided into two sections by a vertically lateral partition. It might be described as a semisubmarine throat as it takes glass horizontally from the melting end and delivers it vertically to the working end. The shallow working end bottom and throat are insulated with 6-inch clay block, which reduce the heat losses due to radiation from these parts. Tank pressure is controlled by an automatic damper, and it is so maintained as to prevent any infiltration of cold air or excessive stingout.

Mixed batch and cullet are delivered in small hopper cans to the charging floor and are handled by an electric monorail hoist. Batch storage for average 16-hour needs is available on the charging floor, with additional space in the basement below, convenient and accessible by reason of the electric hoist. The same handling system delivers batch cans to and removes them from the pusher-type automatic feeders at the two doghouses of the tank. This simple batch-handling system has proved to be reliable and efficient in operation, delivering batch to the tank with a minimum of segregation.

City gas is used as fuel for the type K Hartford-Empire feeders in which each of the 7 channels uses multiburner firing. The glass temperatures in channels and feeders are controlled manually and recorded by potentiometer-type instruments. Forming is done on Hartford-Empire individual section machines, working in conjunction with stackers and types "D" and "LT" lehrs, which are fired with fuel oil.

Another 3-port, cross-fired regenerative tank, recently redesigned for increased efficiency of operation, serves for standby and peak loads of production of high-quality flint ware.

Opal glass for pressed ware is melted in an oil-fired continuous tank of the recuperative type and formed on automatic presses, capable of highly efficient and speedy operation. Another smaller furnace of the same type carries the standby load during repair periods.

An interesting contrast to the highly efficient, automatic production of ware in the machine department is found in the hand shops, a section of the factory which dates from the inception of the Company. Here the time-honored, ages-old art of glass blowing serves those customers who seek ware of quality and design beyond the capabilities of automatic machinery and its efficient operation. Among the employees of this department are many whose period of service with the Company is more than a generation, who have witnessed the advent of the machine, and who, despite the marvelous ingenuity of the machine, can still give it lessons in quality of production.

Flint and colored pot glass is blown, pressed, and formed manually as well as with the aid of hand-operated machines. The machines and their operation should be of particular interest to the engineer, as they illustrate so well the successive steps in the growth and development of the art of glass forming.

The change from hand production to machine production, despite popular belief to the contrary, is seen here to be one of gradual evolution rather than of startling innovation.

Efficient and economical batch mixing is essential to the operation of every successful plant. It is a matter of particular importance and difficulty in any plant that requires a varying number of different batches in quantities, which may vary from 1/4 ton to 80 tons of a batch per day as is the case in this plant. A recent redesign and rebuilding of the batch room and unloading and storage facilities, carried out without interruption to production, has afforded a satisfactory and economical solution of this particular problem.

A matter of especial importance in these days of legislation is that of hazards to the worker's health. An elaborate system for dust removal and ventilation has reduced the irritating dust condition usually associated with batch mixing to a dust concentration better than the standard for country air.

Routine tests and analyses are carried out under laboratory control. An intimate correlation of the well-equipped laboratory with factory operation aids the practical solution of the many developmental problems associated with improvement in glass characteristics and manufacturing research.

A description of most plants would be complete with the foregoing summary, but in the factory of the Carr-Lowrey Glass Company there are several departments which operate as service divisions to those previously mentioned. Thus, there is a ceramic department which produces many of the refractories and clay parts being used in the tank and pot-furnace operations. Here also are made the covered pots in which the glass for the hand shops is melted. These articles call for extraordinary skill in manufacture as they are probably one of the last commercial ceramic items that still defy the ingenuity of the engineers in their forming. They are still examples of the pot-maker's manual dexterity and skill.

A majority of the thousands of molds used by the machine and hand-production departments is the product of the mold shop. Economy and efficiency of operation are aided by labor-saving machinery of recent design. Much of the intricate design work, however, requires the services of highly skilled bench workers.

The luster and brilliance of many of the handmade bottles and stoppers is heightened and increased by the operations of the cutting and polishing department with the aid of stone, felt, cloth wheels, buffs, and various polishing compounds as well as the cutter's patience and skill. Bottles that will hold expensive perfumes and lotions must be evaporation- and leak-proof, and they require the extra protection of a ground-in glass stopper. In the stoppering department, bottles and stoppers are drilled and ground to match each other individually to afford an added measure of protection.

There is an old proverb about "not seeing the forest for the trees," which is another way of saying that perspective is a valuable thing. In few plants today is it possible to view such a breadth of operation spanning the old and new, and such a viewpoint is essential to perspective.

Thanks to Trade Publications

for their fine cooperation and publicity, which will help to make The Society's Forty-Third Annual Meeting one of our best.

Sincerely,

Ross C Purdy

General Secretary

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50 YEARS

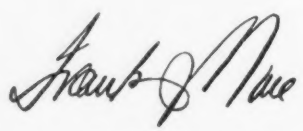
Dr. Edward Goodrich Acheson whose inventive genius in creating the first man-made grinding material gave such impetus to the development of abrasive products that they have become all important factors in making possible vastly increased production and greater precision throughout all industry.

● Never before in history has life been so enriched by scientific discovery and industrial progress as in the half century just completed. We have seen amazing strides in means of transportation . . . the automobile, the airplane, the streamlined train of stainless steel. The electric furnace has given industry new chemicals, new steels, new alloys. We have witnessed the creation of new synthetics, the perfection of the machine tool, the enormous development of mechanical efficiency in every field and the production of countless commodities that promote and protect our way of life.

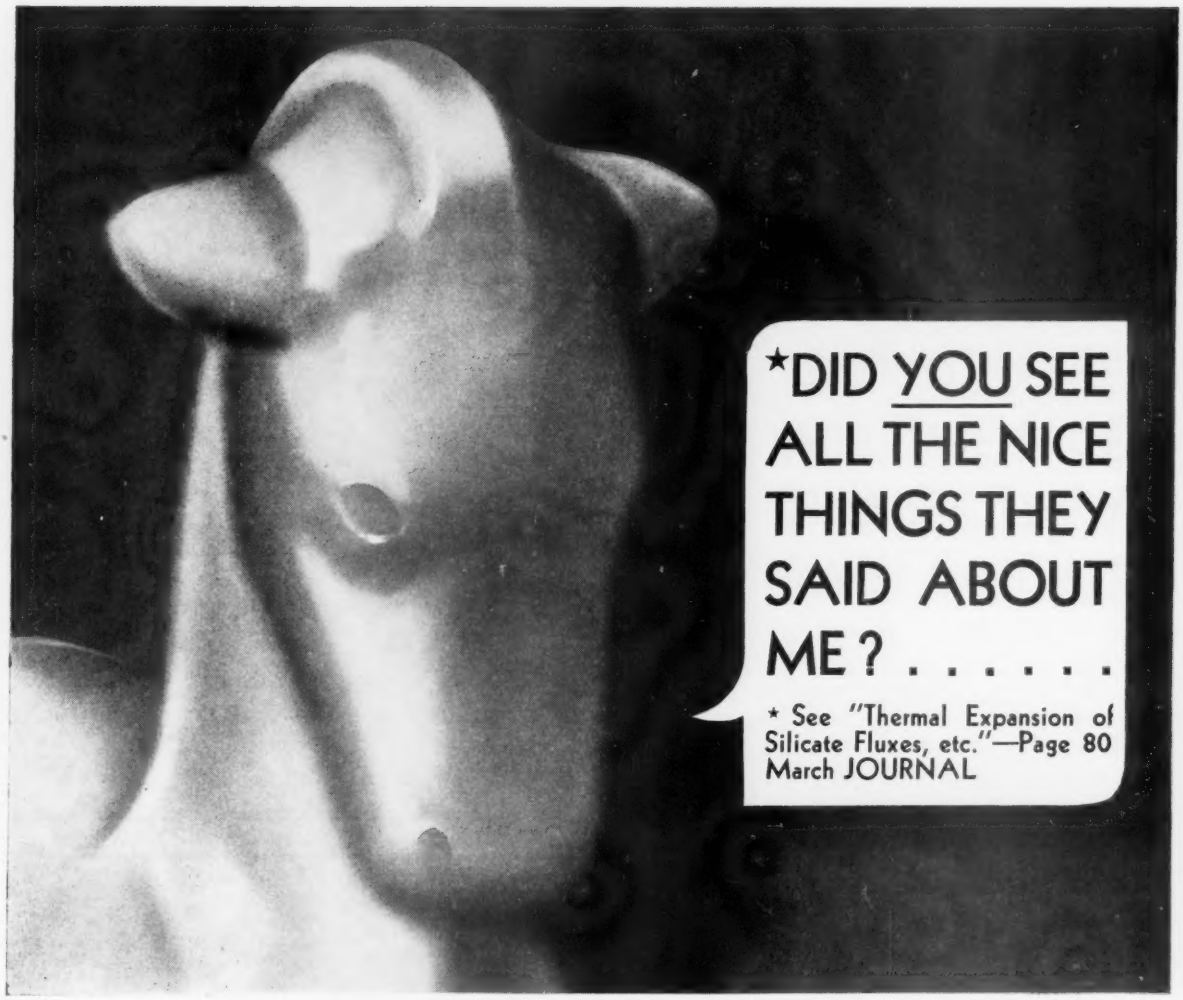
Of all these varied advances none surpass the progress made in the abrasive field. When Dr. Edward Goodrich Acheson created the first man-made abrasive fifty years ago, little did he foresee that modern abrasive products would become one of the industry's most important tools for the shaping, grinding and finishing of almost every device of the useful arts. It shapes the tiny balances of our watches. It smooths the massive casting. It grinds tons of wood pulp for paper making. It fashions marble and stone, finishes wood and leather and sharpens the tools of every craft.

In other words manufactured abrasives are intimately integrated with the very structure of industrial life . . . meeting its fundamental needs, furthering its progress, translating yesterday's luxuries into today's commonplace necessities.

It is with justifiable pride, therefore, that we of The Carborundum Company pay tribute to the late Dr. Edward Goodrich Acheson in commemorating the Fiftieth Anniversary of his creation of silicon carbide, trade named "Carborundum," the first man-made abrasive. It is fitting also that we choose this occasion to acknowledge the splendid cooperation of our friends in industry in bringing his work to fruition and to rededicate this Company's efforts to a continuing service to industry and to the betterment of America's way of life.



FRANK J. TONE, *President,*
THE CARBORUNDUM COMPANY,
NIAGARA FALLS, N. Y.



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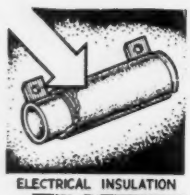
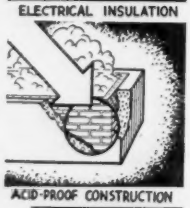
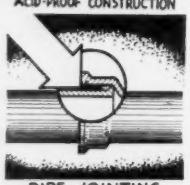


ELECTRICAL INSULATION

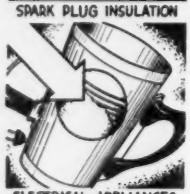


ACID-PROOF CONSTRUCTION



PIPE JOINTING

SPARK PLUG INSULATION



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"	No. 19	Insulating Paint	Superior to asbestos coatings
"	No. 25	Three-Hour Cement	Glass-Block setting—3 hours
"	No. 30	Plastic Porcelain	White, porcelain-like adhesive filler
"	DW-30	Cement	Electric roasters, etc., insulation
"	No. 31	Acidproof Cement	World's best acidproof cement
"	No. 32	Spark Plug Cement	Superior Spark Plug Electrode Sealer
"	No. 35	Iron Cement	Hardens into iron when mixed with water
"	No. 44	Acid Tank Sealer	Black acidproof plastic
"	No. 46	Hydrofluoric Acid Cement	Applied by melting. Immediate use
"	No. 47	Acid Resisting Paint	Prevents corrosion from gases, fumes, etc.
"	No. 48	Joint Compound	Sulphur cement. Water mains and acids
"	No. 49	Melting Compound	Resin cement. Immediate use
"	No. 51	Graphite Paste	Pipe threads—gaskets, etc.
"	No. 52	Pipe Joint Compound	Non-hardening. Clean to use
"	No. 63	Electric Heater Cement	Resists electricity and fire
"	No. 74	Super Refractory Cement	All-purpose heat resisting
"	No. 76	Asbestos Furnace Cement	All-purpose heat sealing. Cold set
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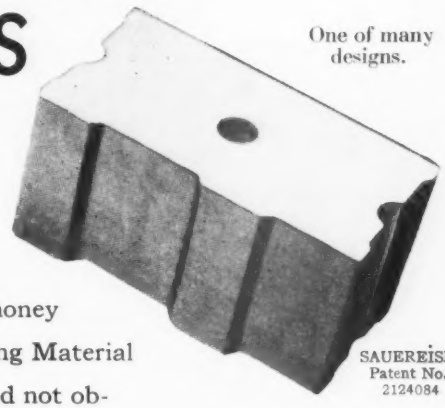

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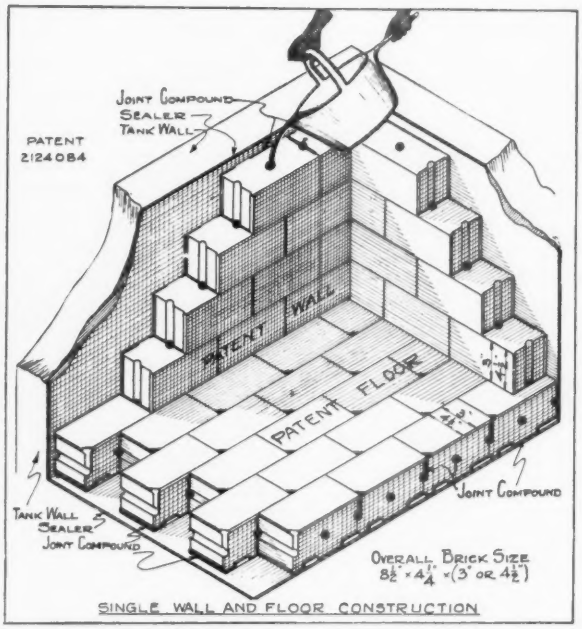

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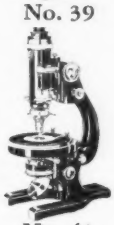

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Pennsylvania Salt Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.
The Vitro Mfg. Co.

Lithium Carbonate
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Lithium Minerals
Foote Mineral Co.

Loaders (Bucket)
National Engineering Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.

Magnesite
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Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Magnesite Calcined
Foote Mineral Co.
The Hommel, O., Co., Inc.

Magnesium Carbonate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Manganese
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Manganese (Oxide)
Ceramic Color & Chemical Mfg. Co.
Corhart Refractories Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Masks (Breathing)
Drakenfeld, B. F., & Co.

Metals (Porcelain Enameling)
American Rolling Mill Co.

Micronized Products
Porcelain Enamel and Mfg. Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Microscopes (Stereoscopic)
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Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Mixers
National Engineering Co.

Mixers (Batch)
Lancaster Iron Works, Inc.
National Engineering Co.

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Mixers (Laboratory)
Lancaster Iron Works, Inc.
National Engineering Co.

Mold Sanders
Lancaster Iron Works, Inc

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Frazier-Simplex, Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.

Mullers (Batch)
Lancaster Iron Works, Inc.
National Engineering Co.

Muriatic Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Needle Antimony
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nepheline Syenite
Great Lakes Foundry Sand Co.

Nickel Salts
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Nitre
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

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Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
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Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Overglaze Colors
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Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

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Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

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Industrial Ceramic Products, Inc.
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Louthan Mfg. Co.
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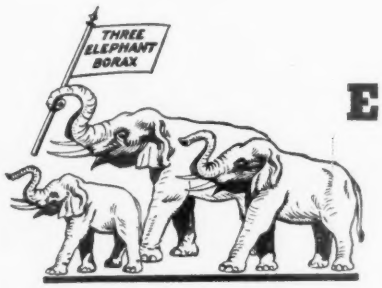

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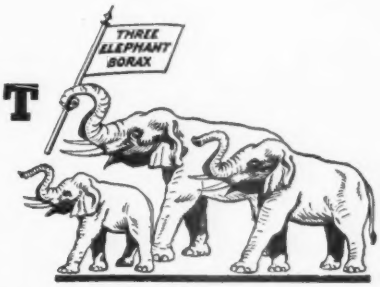

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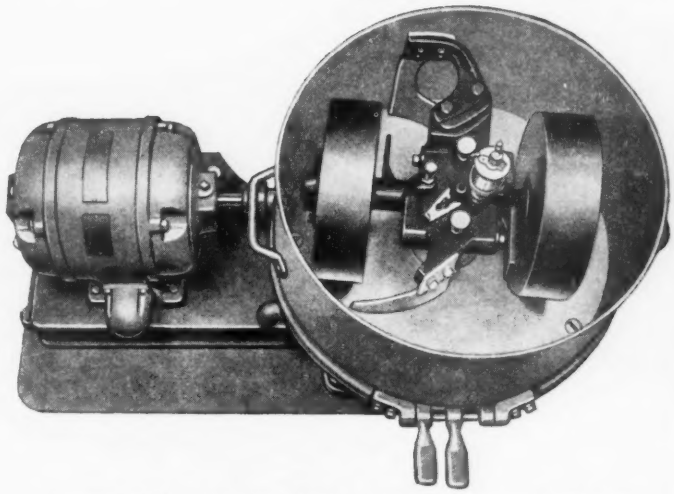

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Norton Co.
Thomas Alabama Kaolin Co.

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Green, A. P., Fire Brick Co.
Thomas Alabama Kaolin Co.

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Harshaw Chemical Co.
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Titanium Oxide
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Metal & Thermit Corp.
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The Vitro Mfg. Co.

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Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
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The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

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Zirconia
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Metal & Thermit Corp.
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The Vitro Mfg. Co.

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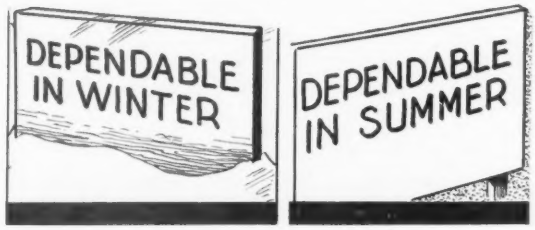

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We embark on this, our fiftieth anniversary as the world's most complete ceramic supplier, with the firm resolve to continue to develop new methods, new materials, and new ideas for the successful progression of the ceramic industry, always bearing in mind that our success will not be measured by the number of years we have been in existence, but rather by the contributions we have made to the great industry we serve.

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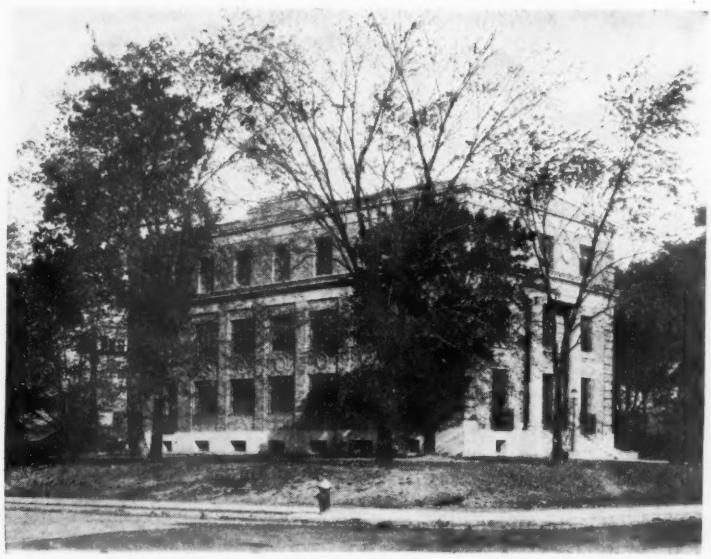

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In the ceramic, enamel, and glass industries, Kryolith has become known as an ideal flux. Manufacturers of glassware, for instance, find that Kryolith helps to reduce the tendency toward cords, while its powerful fluxing action is uniform and efficient. Kryolith aids in dissolving many of the coloring oxides, helps to improve the color and lustre of the finished product, and is a valuable constituent of nearly any formula. It aids in opacification and is compatible with practically all opacifiers.

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THE NATURAL GREENLAND CRYOLITE

PENNSYLVANIA SALT
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Spurs
Saggers
Crucibles
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We Sell—

Ball Clays—Kentucky
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Bitstone—all sizes
Fire Brick
Imported Paris White
Domestic Whiting
Georgia Kaolin
Modeling Clay

THE POTTERS SUPPLY COMPANY
EAST LIVERPOOL, OHIO

FORTY-THIRD
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MARCH 30 – APRIL 5

THE AMERICAN
CERAMIC SOCIETY

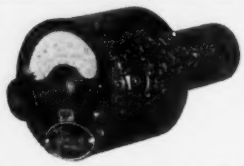
BALTIMORE, MD.

PYRO THE SIMPLIFIED OPTICAL PYROMETER

YOU cannot afford NOT to own one!

BECAUSE it eliminates guesswork, waste and spoilage; it pays for itself quickly. PYRO is a SELF-CONTAINED, DIRECT-READING, STURDY unit made to stand rough use but it is absolutely accurate and dependable.

Unique construction enables operator to rapidly determine temperature even on minute spots, fast moving objects or the smallest streams; no correction charts, no accessories, no upkeep.



PYRO RADIATION-PYROMETER

Ideal for furnace or kiln use. Gives actual heat of material aside from furnace or kiln temperature. Does not require skilled operator. Write for special bulletins.

THE PYROMETER INSTRUMENT CO.
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Tunnel, Truck and Humidity Dryers for—

Dry Pressed Electrical Porcelain
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DUPONT COLORS
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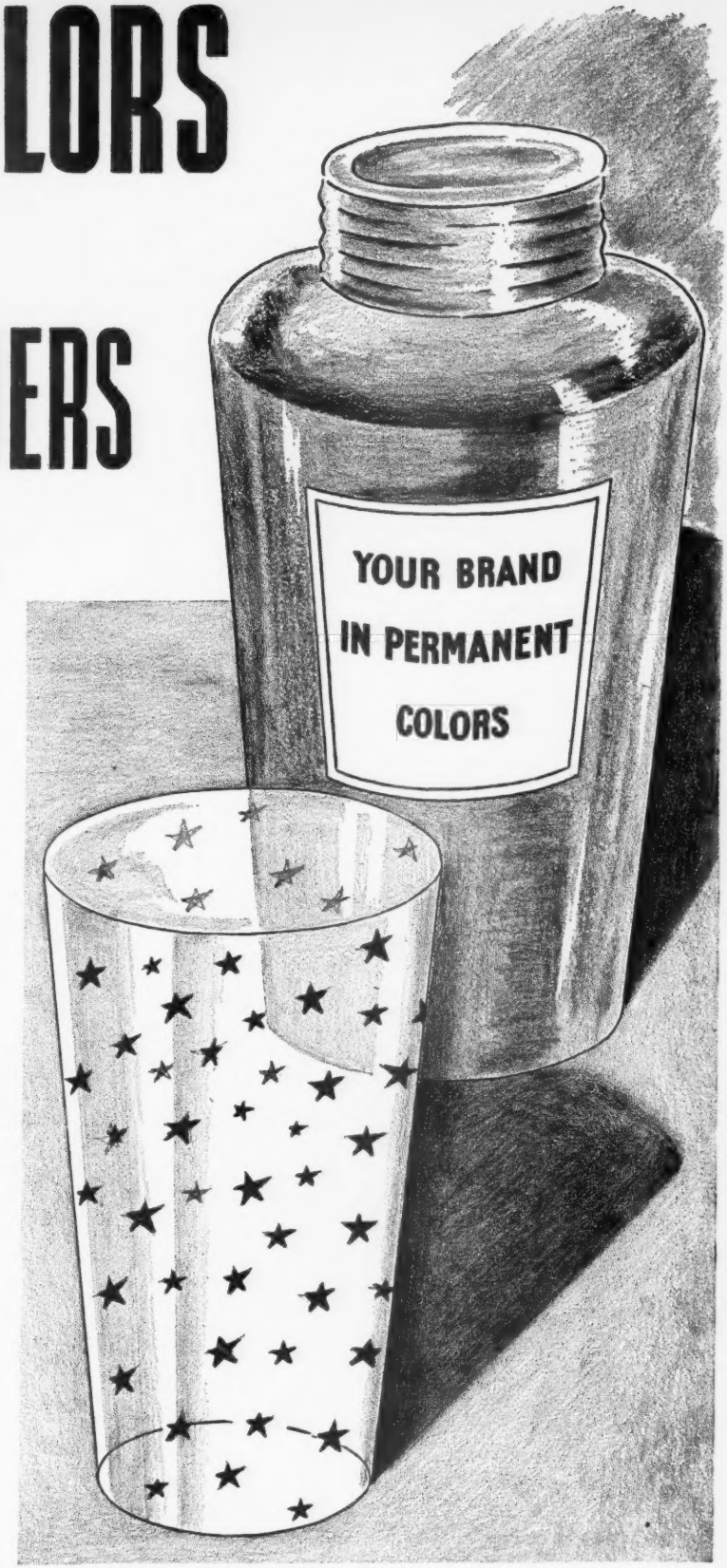

Du Pont's New Super-Resistant Colors Designed to Withstand **SEVERE SERVICE**

IT took years of extensive research to develop this line of resistant colors for decorative labels on bottles and glass containers. They are now standard in most plants doing applied color decorating because they are:

★ *Alkali-Resistant* — Repeated exposure to hot caustic solutions prove the superiority of these colors, their ability to stand up under drastic treatment.

★ *Acid-Resistant* — Extremely high—something once considered impossible to obtain jointly with high alkali resistance.

★ *Strain-Free*—Perfect matching of expansion coefficients with those of commercial bottle glass assures absence of strain or breakage troubles from these colors.

★ *Easily Applied* — Smooth, even color applications of exceptionally high gloss—easily adapted to the heaviest of multi-layer designs—can be obtained without the troubles usually associated with heavy applications.

No other colors can offer this combination of advantages. And with them is offered du Pont technical service, experienced men to assist in solving problems in applied color label decoration and in the working out of the most efficient production set-up possible for the individual shop.

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PRODUCTS
DIVISION

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INCORPORATED
The R. & H. Chemicals Department
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FOR SALE—One thousand acres (more or less) of finest ganister land. Situated opposite Pennsylvania Railroad. Located in Juniata and Mifflin Counties. Price reasonable. Address Box 85, Mifflintown, Pa.

Drills Perfect HOLES or CORES at HIGH SPEED and LOW COST

The H-S Portable Abrasive Speed Drill drills a clean, sharp, accurate hole in a fraction of time required by other methods. Example: 1½″ diameter hole in ¼″ plate glass in 60 seconds. Easy, safe to operate—no special skill required. Horizontal or vertical drilling. Drills all Ceramic Materials. Send for free, descriptive folder listing nationally known users.

HOWE-SIMPSON, Inc.
Spar Bldg. Columbus, O.

H-S Portable SPEED DRILL

INDUSTRIAL CERAMIC PRODUCTS, Inc.
MANUFACTURERS
PINS CONE PLAQUES STILTS
COLUMBUS, OHIO

All Types of Circular and Straight Tunnel Kilns
SWINDELL-DRESSLER CORPORATION
Post Office Box 1888 Pittsburgh, Pa.
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Full Details Furnished on Request

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Manufacturers of
PYROMETER TUBES AND INSULATORS
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BEAVER FALLS PENNSYLVANIA

CLAY PROPERTY FOR SALE

Tract of about 360 acres containing large deposit of clay suitable for various clay products. Property also contains sand and gravel.

Located on main line Pennsylvania Railroad midway between Baltimore and Washington and adjoins Fort Meade in Anne Arundel County, Maryland.

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701 South Caton Avenue
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HERE IS OPPORTUNITY!

Completely equipped Pottery Plant located in one of Texas largest cities. Owner will sell same outright at bargain price, practically speaking, on your own terms if purchasers are capable and have good history behind them. Entire plant and real estate is clear of debt. Our client would even consider putting some money into deal with competent men who would invest their capital and take over entire management of production and sales as owner's other holdings keep him occupied elsewhere. Plant is producing some products now.

If you are sincere and can meet the requirements tell us about yourself and the amount of capital you would invest. Your confidence will be respected.

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"22 Years of Continuous Service"
1006 Main St., Houston, Texas

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CHEMISTS FOR THE CERAMIC INDUSTRY
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WANTED POSITION
Ceramic engineer with sixteen years experience including ten years thorough training in control, supervision and administration in the sanitary pottery industry desires position of responsibility with future prospects. Write box 190F, American Ceramic Society, 2525 N. High St., Columbus, Ohio.

Each Can Say

"I WAS A CLERK"

"I WAS A LINEMAN"

"I WAS A DRAFTSMAN"

THIRTY-SEVEN years ago, in 1904, the president of the American Telephone and Telegraph Company went to work as a clerk in one of the Bell System companies.

About that time, the 18 men who are now the presidents of the Bell telephone companies were starting their careers.

For, like the head of the System itself, they have worked many years in the business—an average of 38 years each. Each of them can say: "I was a clerk," "I was a lineman," "I was a draftsman" —and so on.

The "know how" is here—for the every-day job of running the telephone business or to serve you in emergency. Up-from-the-ranks management is doubly important these days.

BELL TELEPHONE SYSTEM

The Bell System is doing its part in the Country's program of National Defense.

H. C. SPINKS CLAY COMPANY

Miners and Shippers of

BALL, SAGGER AND WAD CLAY

NEWPORT, KY.

March 1, 1941

Mr. Pete Potter
Comfortable Sanitary Pottery Mfg. Co.
Pottsville, U. S. A.

Dear Pete:

Was out bird hunting down around the mines this winter when I met a boy carrying three nice squirrels but no gun. I asked him how he had killed them and he pulled a rock out of his pocket. I said, "Boy, you can't kill a squirrel with a rock." All he said was, "Show me one." Well, we found one in a high tree and he threw his rock and down came the squirrel. I said, "Boy, you ought to sign up with the Reds. They need a right-hander with that much speed and control." He said, "Mister, I'd like to, but I ain't right-handed. I just kill squirrels with my right hand on account of when I throw with my left I tear 'em up too bad."

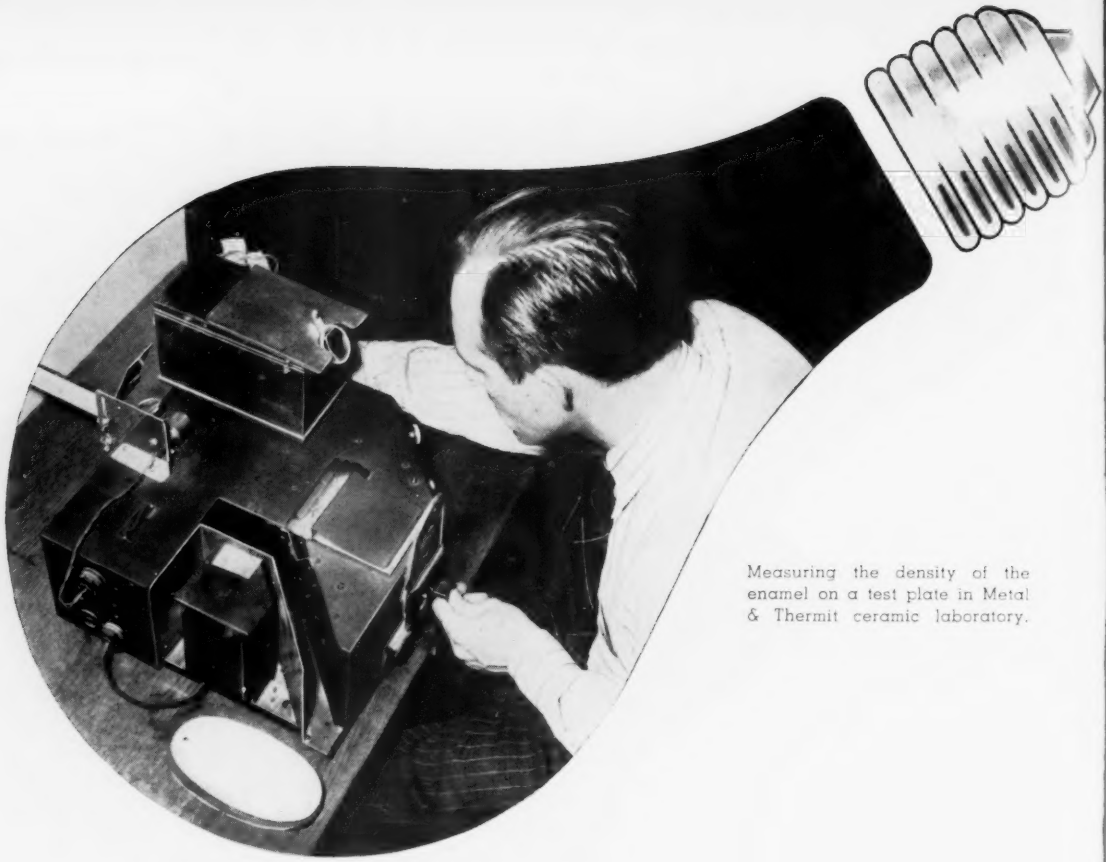
Well, Pete, we use plenty of speed in filling our orders, and although we don't have as much control as that boy, we do our best to keep the quality uniform.

Sincerely,

Dick Carothers

General Manager
H. C. SPINKS CLAY COMPANY

RBC:MLN



Measuring the density of the enamel on a test plate in Metal & Thermit ceramic laboratory.

throwing light on opacity...

A manufacturer of reflectors had to stop production because he found that the opacity of the glaze was not adequate to meet rigid reflectance specifications.

Metal & Thermit engineers were called in. An improvement in reclaiming spray booth scrapings and a change to M & T Tin Oxide remedied the condition and enabled production to be immediately resumed.

If you have a glaze or enamel production problem consult us about it. The experience of our ceramic laboratory in solving hundreds of problems involving the production of glazes and enamels to meet all sorts of conditions, is at your disposal.

Here are two opacifiers which have been proven again and again by leading ceramic manufacturers as to purity, uniformity and ability to impart a brilliant, even finish. Careful laboratory control in the manufacture of the opacifiers and continual production of test samples of enamels are a constant check on their quality.

M&T

TIN OXIDE

SODIUM ANTIMONATE

★

METAL & THERMIT CORPORATION

120 BROADWAY NEW YORK, N. Y.